Chapter 1
Information Systems in Global Business Today

Introduction

Computers and Information technology (IT) are changing every aspect of our lives from entertainment to shopping, from the work we do and where we do it, to how we communicate with friends and relatives. Many companies are remodeling their businesses and information systems with the Internet in mind. IT is dramatically changing the business landscape and significantly affecting strategic options and creating opportunities and issues that managers need to address in many aspects of their business. Some of the key impacts of technology and the implications for management are:

- → **Business Strategy** - collapsing time and distance, enabling electronic commerce
- → **Organization Culture** - encouraging the free flow of information
- → **Organization Structures** - making networking and virtual corporations a reality
- → **Management Processes** - providing support for complex decision making processes
- → **The workplace** - allowing work from home and on the move

The Role of Information Systems in Today's Business

Information systems are essential for conducting day-to-day business as well as achieving strategic business objectives. Some firms, such as Amazon and ETrade, would be nonexistent without information systems. It is difficult to imagine some service industries, such as finance, insurance, and real estate industries, could not operate without information systems. The ability of a firm to use IT is becoming intertwined with the firm's ability to implement corporate strategy.

As electronic business and electronic commerce grow in popularity and more firms digitize their operations, having useful information is becoming even more important to the global business community. Business firms invest heavily in information systems to achieve six strategic business objectives: operational efficiency, new products, services & business models, customer and supplier intimacy, better decision making, competitive advantage, and survival.

How Information Systems Are Transforming Business

Wireless communications, including computers and mobile hand-held computing devices, are keeping managers, employees, customers, suppliers, and business partners connected in every way possible. Email, online conferencing, the Web, and the Internet, are providing new and diverse lines of communication for all businesses, large and small. Through increased communication channels and decreased costs of the communications, customers are demanding more of businesses in terms of service and product, at lower costs. E-commerce is changing the way businesses must attract and respond to customers.

What's New in Management Information Systems?

The use of technology now extends far beyond the simple desktop computer, especially in the business world. There are three interrelated changes that are affecting companies worldwide:

→ **The emerging mobile digital platform**: More and more business computing is moving from PCs and desktop machines to mobile devices like IPhones, iPads, Smart Phones etc. Managers are increasingly using these devices to coordinate work, communicate with employees, and provide information for decision making.

→ **Growth of businesses use of big data**: The use of Big Data — large pools of data that can be brought together and analyzed to discern patterns and make better decisions — will become the basis of competition and growth for individual firms, enhancing productivity and creating significant value for the world economy by increasing the quality of products and services.

All companies need to take Big Data and its potential to create value seriously if they want to compete. For example, some retailers embracing big data see the potential to increase their operating margins.

→ **Growth of cloud computing**: Cloud computing is a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications. Main objective is to provide different services — such as servers, storage and applications — to an organization's computers and devices through the Internet. The cloud has changed the fundamental nature of computing and how business gets done. According to the research done by Global Industry Analysts Inc, cloud computing came as a boon for companies during tough economic and financial climate, given that the technology can potentially slash IT costs by over 35%

Globalization Challenges and Opportunities: A Flattened World

Customers no longer need to rely on local businesses for products and services. They can shop at any time and any day of a week for virtually anything and have it delivered to their door or desktop. Companies can operate at any time from any geographic location around the world. Jobs can just as easily move across the state or across the ocean. The emergence of the Internet into a full blown international communications system has drastically reduced the costs of operating and transacting business on a global scale.

The move to a global economy has been facilitated by advanced telecommunications networks and particularly by the Internet. At the same time globalization adds challenges to businesses. In a global market cost of labor, varies widely among countries. In general, labor costs are higher in developed countries than in developing countries. Also, developed countries usually pay high fringe benefits to employees, which make the cost of doing business even higher. Therefore, many labor-intensive industries have moved their operations to countries with low labor costs. These moves are greatly facilitated with IT.

The Emerging Digital Firm

A **digital firm** is one in which nearly all of the organization's significant business relationships with customers, suppliers, and employees are digitally enabled, and key corporate assets are managed through digital means. These digital networks are supported by enterprise class technology platforms that have been leveraged within an organization to support critical business functions and services. Some examples of these technology platforms are Customer Relationship Management (CRM), Supply Chain Management (SCM), Enterprise Resource Planning (ERP), Knowledge Management (KMS), Enterprise Content Management (ECM), and Warehouse Management System (WMS). Making a firm digital is not about just adding a computer system to the mix. Throwing a computer system at outdated business processes is exactly the wrong thing to do. A truly digital firm has several characteristics that distinguish it from most of the firms claiming to be digitized:

→ Significant business relationships with customers, suppliers, and employees are digitally enabled and mediated.

→ Core business processes are accomplished through digital networks spanning the entire organization or linking multiple organizations.

→ Key corporate assets – intellectual property, core competencies, and financial and human assets – are managed through digital means.

→ They sense and respond to their environments far more rapidly than traditional firms.

→ They offer extraordinary opportunities for more flexible global organization and management, practicing time-shifting (business being conducted 24 hrs x7 day) and space-shifting (business being conducted globally or beyond traditional geographic boundaries).

Strategic Business Objectives of Information Systems

Strategic planning for an organization involves long-term policy decisions, like location of a new plant, a new product, diversification etc. Information technology has played an important part in the U.S. and global economies. Companies rely on IT for fast communications, data processing and market

intelligence. Specifically, business firms invest heavily in information to achieve six strategic business objectives:

→ Operational excellence
→ New products, services, and business models
→ Customer and supplier intimacy
→ Improved decision making
→ Competitive advantage
→ Survival

Operational Excellence: This relates to achieving excellence in business in operations to achieve higher profitability. For example, a consumer goods manufacturer may decide upon using a wide distribution network to get maximum reach to the customers and exposure. A manufacturing company may pursue a strategy of aggressive marketing and mass production.

New Products, Services, and Business Models: This is part of growth strategy of an organization. With the help of information technology, a company might even opt for an entirely new business model, which will allow it to establish, consolidate and maintain a leadership in the existing market as well as provide a competitive edge in the industry. As successful as Apple Inc., BestBuy, and Walmart were in their traditional brick-and-mortar existence, they have all introduced new products, services, and business models that have made them even more competitive and profitable.

Customer and Supplier Intimacy: When a business really knows its customers, and serves them well, the way they want to be served, customers generally respond by returning and purchasing more. The result is increased revenues and profits. Likewise with suppliers: The more a business engages its suppliers, the better the suppliers can provide vital inputs. The result is a lower cost of doing business. JC Penney is an excellent example of how the use of information systems and technologies are extensively used to better serve suppliers and retail customers. Its information system digitally links the supplier to each of its stores worldwide. Suppliers are able to ensure the continuous flow of products to the stores in order to satisfy customer demands.

Improved Decision Making: A very important pre-requisite of strategic planning is to provide the right information at the right time to the right person, for making an informed decision. Well planned Information Systems and technologies make it possible for the decision makers to use real-time data from the marketplace when making decisions. Previously, managers did not have access to accurate and current data and as such relied on forecasts, best guesses, and luck. The inability to make informed decisions resulted in increased costs and lost customers.

Competitive Advantage: Doing things better than your competitors, charging less for superior products, and responding to customers and suppliers in real time all add up to higher sales and higher profits that your competitors cannot match. Toyota and Walmart are prime examples of how companies use information systems and technologies to separate themselves from their competition. Toyota worked its way to top of its industry with the help of its legendary information system. Walmart is the most efficient retail store in the industry based in large part on how well it uses its information resources.

Survival: Firms also invest in information systems and technologies because they are necessities for doing business. Information systems are not a luxury. In doing so, they had a major competitive advantage over their competitors. In order to remain and survive in the retail banking industry, other banks had no choice but to provide ATM services to banking customers.

Data Vs Information

Data is a collection of raw facts that may or may not be meaningful for managers. Input to any system may be treated as Data. It is very difficult to understand data and needs to be processed to understand. Data may not be in the order.

Information is the outcome derived after processing the data and is always meaningful. Output after processing the system is Information. Processing is performed by performing arithmetic logical calculations on data of simply by rearranging the data. It is very easy to understand information. Information should be in the order.

For example, researchers who conduct market research survey might ask a member of the public to complete questionnaires about a product or a service. These completed questionnaires are data; they are processed and analyze in order to prepare a report on the survey. This resulting report is information.

Characteristics of Information

Good information is that which is used and which creates value. Experience and research shows that good information has numerous qualities.

- **Availability/accessibility:** Information should be easy to obtain or access. Information kept in a book of some kind is only available and easy to access if you have the book to hand. A good example of availability is a telephone directory, as every home has one for its local area.
- **Accuracy:** Information needs to be accurate enough for the use to which it is going to be put. To obtain information that is 100% accurate is usually unrealistic as it is likely to be too expensive to produce on time. Accuracy is important. As an example, if government statistics based on the last census wrongly show an increase in births within an area, plans may be made to build schools

and construction companies may invest in new housing developments. In these cases any investment may not be recouped.

- ☞ **Reliability or objectivity:** Reliability deals with the truth of information or the objectivity with which it is presented. You can only really use information confidently if you are sure of its reliability and objectivity. Unless you know who the author is, or a reputable university or government agency backs up the research, then you cannot be sure that the information is reliable. Some Internet websites are like vanity publishing, where anyone can write a book and pay certain (vanity) publishers to publish it.
- ☞ **Relevance/appropriateness:** Information should be relevant to the purpose for which it is required. It must be suitable. What is relevant for one manager may not be relevant for another. The user will become frustrated if information contains data irrelevant to the task in hand. For example, a market research company may give information on users' perceptions of the quality of a product. This is not relevant for the manager who wants to know opinions on relative prices of the product and its rivals. The information gained would not be relevant to the purpose.
- ☞ **Completeness:** Information should contain all the details required by the user. Otherwise, it may not be useful as the basis for making a decision. For example, if an organization is supplied with information regarding the costs of supplying a fleet of cars for the sales force, and servicing and maintenance costs are not included, then a costing based on the information supplied will be considerably underestimated.
- ☞ **Level of detail/conciseness:** Information should be in a form that is short enough to allow for its examination and use. There should be no extraneous information. For example, it is very common practice to summaries financial data and present this information, both in the form of figures and by using a chart or graph. We would say that the graph is more concise than the tables of figures as there is little or no extraneous information in the graph or chart. Clearly there is a trade-off between level of detail and conciseness.
- ☞ **Presentation:** The presentation of information is important to the user. Information can be more easily assimilated if it is aesthetically

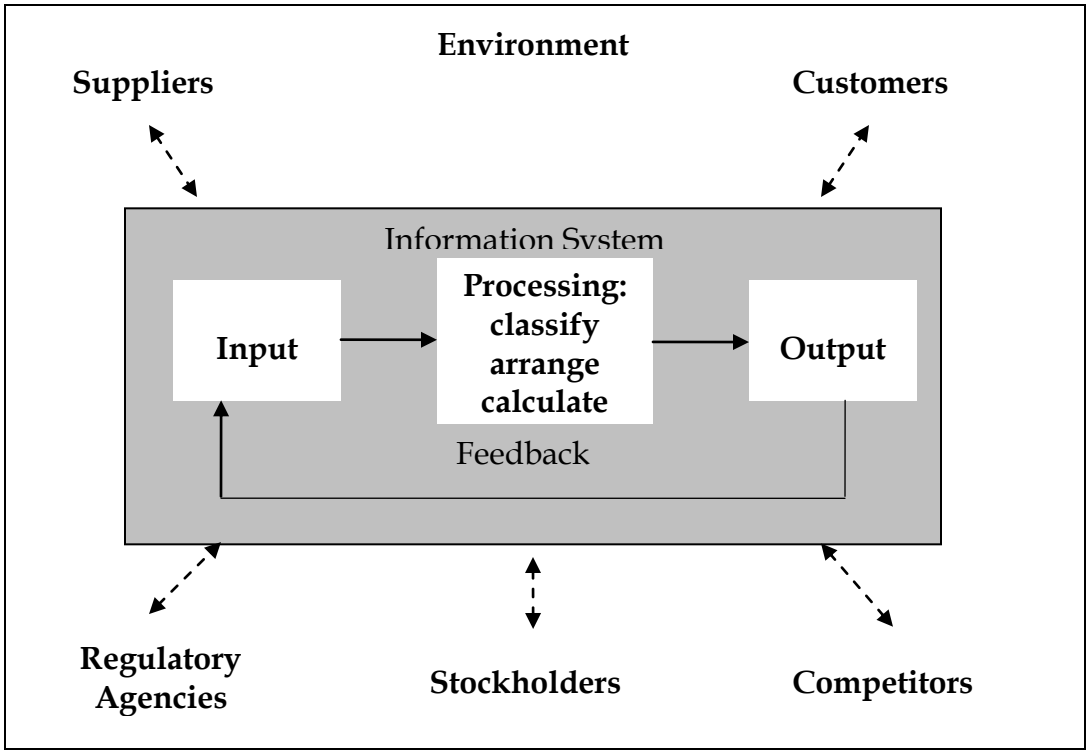
pleasing. For example, a marketing report that includes graphs of statistics will be more concise as well as more aesthetically pleasing to the users within the organization.

- ☞ **Timing:** Information must be on time for the purpose for which it is required. Information received too late will be irrelevant. For example, if you receive a brochure from a theatre and notice there was a concert by your favorite band yesterday, then the information is too late to be of use.

Information Systems

In a simplest sense, a system that provides information to people in an organization is called **information system (IS)**. It can be defined as a collection of interrelated components working together to collect, process, store, and disseminate information to support decision making, coordination, control, analysis, and visualization in an organization. An information system is an organized combination of people (persware), hardware, software, communication networks, and data resources.

Information systems in organizations capture and manage data to produce useful information that supports an organization and its employees, customers, suppliers and partners. So, many organizations consider information system to be the essential one. Information systems produce information by using data about significant people, places, and things from within the organization and/or from the external environment to make decisions, control operations, analyze problems, and create new products or services. As already mentioned, **Information** is the data shaped into a meaningful form. **Data**, on the other hand, are the collection of raw facts representing events occurring in organizations or the environment before they have been organized and arranged into a form that people can understand and use.



The three basic activities to produce information in an information system are *input, processing, and output*.

→ **Input** captures or collects raw data from within the organization or from its external environment for processing. Normally input is hardware component of information systems.

→ **Processing** converts raw data into the meaningful information. Normally processing is done by software. Processing is done either by performing arithmetic or logical calculations on the data or by simply rearranging the data.

→ **Output** transfers information produced from processing data to the people who will use it or to the activities for which it will be used.

Information systems also include two additional components: *feedback and control*.

- **Feedback:** It is data about the performance of a system. It is the idea of monitoring the current system output and comparing it to the system goal. For example, data about sales performance is feedback to a sales manager.
- **Control:** On the basis of feedback, the control function makes necessary adjustments to a system's input and processing components to ensure that it produces proper output. For example, a sales manager exercises control when reassigning salespersons to new sales territories after evaluating feedback about their sales performance.

The two types of information systems are **formal** and **informal**. **Formal information systems** are based on accepted and fixed definitions of data and procedures for collecting, storing, processing, disseminating, and using these data with predefined rules. **Informal information systems**, in contrast, relay on unstated rules. Formal information systems can be **manual** as well as **computer based**. **Manual information systems** use paper-and-pencil technology. In contrast, **computer-based information systems (CBIS)** relay on computer hardware and software for processing and disseminating information.

Dimensions of Information Systems

An information system represents a combination of management, organization, and technology elements. The management dimension of information systems involves leadership, strategy, and management behavior. The technology dimensions consist of computer hardware, software, data management technology, and networking/telecommunications technology (including the Internet). The organization dimension of information systems involves the organization's hierarchy, functional specialties, business processes, culture, and political interest groups.

Organizations

Organizations are formal social units developed to the attainment of specific goals. The key elements of an organization are its **people, structure, operating procedures, politics, culture**, and **functional specialties**.

- **People:** Organizations require many different kinds of skills and people like managers (such as senior, middle, and operational) who make decisions and plans to solve organizational problems, knowledge workers (such as engineers, architects, or scientists) who design products or services and create new knowledge, data workers (such as secretaries, bookkeepers, or clerks) who process the organizations paperwork, and production or service workers (such as machinists, assemblers, or packers) who actually produce the organizations products or services.
- **Structure:** Organizations coordinate work through a structured hierarchy. The hierarchy arranges people in a pyramid structure of rising authority and responsibility. The upper levels of hierarchy consist of managerial, professional, and technical employees, whereas the lower levels consist of operational personnel.
- **Standard Operating Procedures (SOPs):** Standard operating procedures (SOPs) are formal rules that have been developed over a long time for achieving organizational goals. Firm's business processes are based on its SOPs.

- **Organizational Politics:** People in organization occupy different positions with different specialties, concerns and perspectives. As a result, they naturally have divergent and differing viewpoints about how Resources, Rewards, and Punishments should be distributed. This will result in political struggle for resources, competition and conflict within every organization.
- **Organizational Culture:** It is a set of fundamental assumptions about what products the organization should produce, how it should produce them, where, and for whom. Organizational culture is a powerful restraint on change, especially technology change. Any technological change that threatens commonly held cultural assumptions usually meets a great deal of resistance.
- **Business Functions:** The major business functions, or specialized tasks performed by business organizations include sales and marketing (selling the organization's products and services), manufacturing and production (producing products and services), finance (managing the organization's financial assets like cash, stocks, etc.), accounting (maintaining the organization's financial assets and accounting the flow of funds), and human resources (attracting, developing, and maintaining the organization's labor force; maintaining employee records).

Management

Management's job is to make decisions and formulate action plans to solve organizational problems. Managerial roles and decisions vary at different levels of the organization. Senior managers occupy the topmost hierarchy and are responsible for making long-range decisions. Middle managers occupy in the middle of the organizational hierarchy who are responsible for carrying out the plans and goals of senior management. Operational managers monitor the day-to-day activities of the organization.

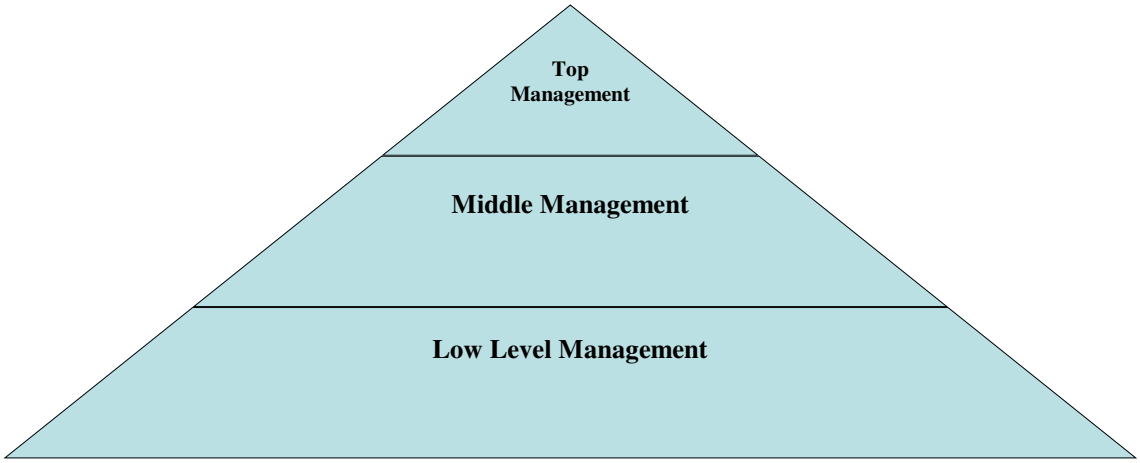
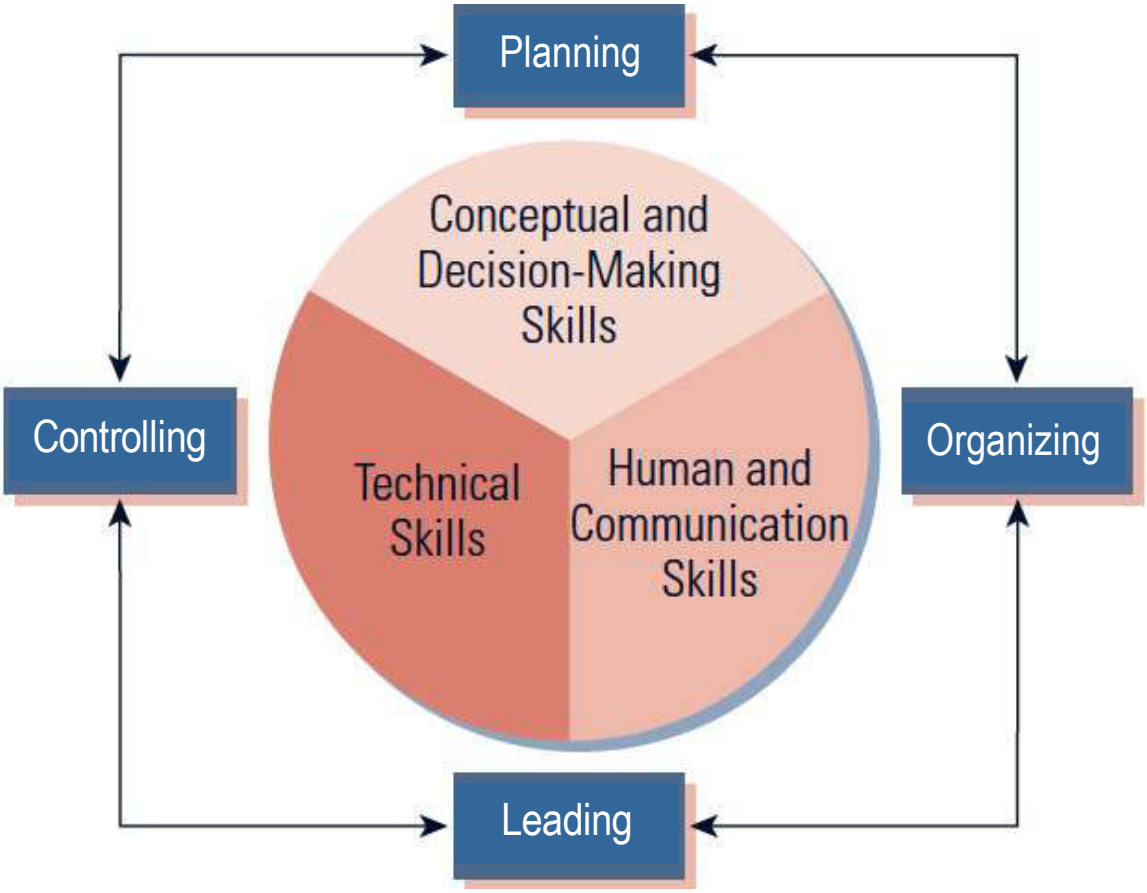


Fig: Different level of management

Managers play an important role in organizations. We can understand managerial functions by examining classical and contemporary models of managerial behavior.

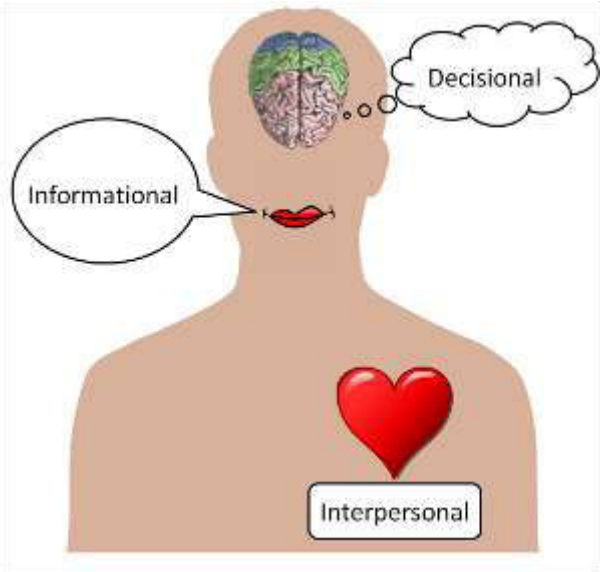
- **Classical Models of Management:** The classical descriptions of management focuses on five classical functions of managers like **planning**, **organizing**, l**eading**, and **controlling**. These terms actually describe formal managerial functions and are unsatisfactory as a description of what managers actually do in their jobs. For example, these terms do not address what managers actually do when they plan, decide things, and control the work of others.



Above figure shows systems relationship among the management functions. **Planning** includes setting objectives and determining in advance **exactly** how the objectives will be met. **Organizing** means delegating and coordinating tasks and allocating resources to achieve objectives. Managers should also show **leadership**. He/she should influence employees to work towards achieving objectives. **Controlling** means managers should establish and implement mechanisms to ensure that objectives are achieved.

- **Behavioral Models of Management:** These models describe management based on what managers actually do in their jobs. Managers' day-to-day behavior can be classified into 10 managerial roles. **Managerial roles** are expectations of activities that managers should perform in an organization. These roles fall into three categories: interpersonal, informational, and decisional.

- **Interpersonal Roles:** Interpersonal management roles are grouped into three roles involving working with other people. Managers act as figureheads, leaders, and liaisons.
- **Informational Roles:** Informational management roles are divided into three different communication-based roles. Managers act as nerve centers, disseminators, and spokespersons.
- **Decisional Roles:** Decisional management roles are sorted into four action-based roles for making and implementing decisions. Managers act as entrepreneurs, disturbance handlers, resource allocators, and negotiators.



Information Technology

Information technology is the tool used by managers to deal with change. The technology dimension consists of computer hardware, software, data management technology, and networking/telecommunications technology

- **Computer Hardware:** It is the physical equipment used for input, processing, and output activities in an information system. It consists of processing unit; various input, output, and storage devices; and physical media to link these devices together.
- **Computer Software:** It consists of detailed preprogrammed instructions that control and coordinate the work of computer hardware components in an information system.
- **Data Management Technology**: In order to keep track of all of the information stored, we need **data management** software that is

designed to organize the information so that we can readily retrieve what we are looking for.

- ☞ **Communication technology:** It includes physical devices and software that link various computer hardware components that transfer data from one physical location to another. This technology helps to connect computers and communication equipments for sharing voice, data, images, sound, or video in networks. A **network** links two or more computers to share data and resources.

All the above technologies collectively form the firm's **information technology (IT) infrastructure**. The IT infrastructure provides the foundation or platform on which the firm can build its specific information systems. So, each organization must carefully design and manage its IT infrastructure according to the needs of the information system.

A Business Perspective on Information Systems

From a business perspective, an information system provides a solution to a problem or challenge facing a firm and provides real economic value to the business. The decision to build or maintain an information system assumes that the returns on this investment will be superior to other investments in buildings, machines, or other assets. These superior returns will be expressed as:

- Increased productivity
- Increased Revenues
- Superior long-term strategic Positioning

As already mentioned information systems collects data from environment and produces information. This information is useful for managers to perform managerial tasks such as planning, coordinating, controlling and decision making. On the other hand information produced by these systems will be helpful to different business processes such as supply-chain management, customer relationship management, and knowledge management. Combination of these two perspectives ultimately helps in increasing firm's profitability and achieving strategic position. There are three ways an information system can add value to a business:

- Help managers make better decisions
- Help make business processes more efficient
- Increase profitability

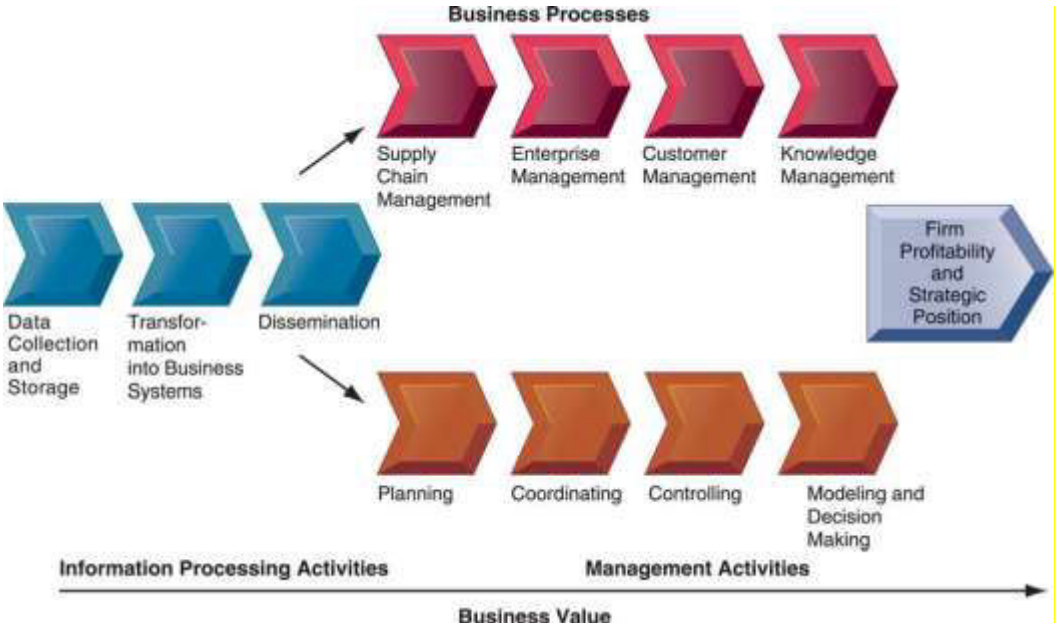


Figure: The Business Information Value Chain

Complementary Assets: Organizational Capital and the Right Business Model

Assets that are required to derive value from primary investment are called complementary assets. For example, to get real value from water resources requires investments in hydropower's, transmission lines, legal regulatory structures etc. Thus theses investments are complementary for getting real values from investments in water resources. In the same way investing just in IT may not give attractive returns to organizations.

Studies show that there are considerable variations in returns from investments in information technology. Some organizations invest great deal of amount and also able to achieve great deal of values from this investment. On the other hand some organizations invest great deal of

amount and are only able to achieve little value from this. Third variation is the organizations that invest little in information technology but able to get great deal of returns. The fourth types of organizations are those that invest little in IT and also get little and also get little returns from it. This clearly indicates that investing in information technology does not guarantee good returns. The reason behind this is the concept of complementary assets.

Investments in information technology alone cannot make managers and organizations more effective. Thus, to get proper returns from investment in IT, organizations needs to invest in complementary assets also. Some organizations do not invest in discovering new business model or seeks to preserve existing business model even after investing in new technology. Due to this organization may be unable to take advantages of new technology and hence unable to get returns from investment in new technology.

According to Kauffman et. al. complementary assets for investment in information technology are investment in new business models, new business process, management behavior, organizational culture, trainings etc. Organizations that do not invest in theses complementary assets can no get superior returns from investments in IT.

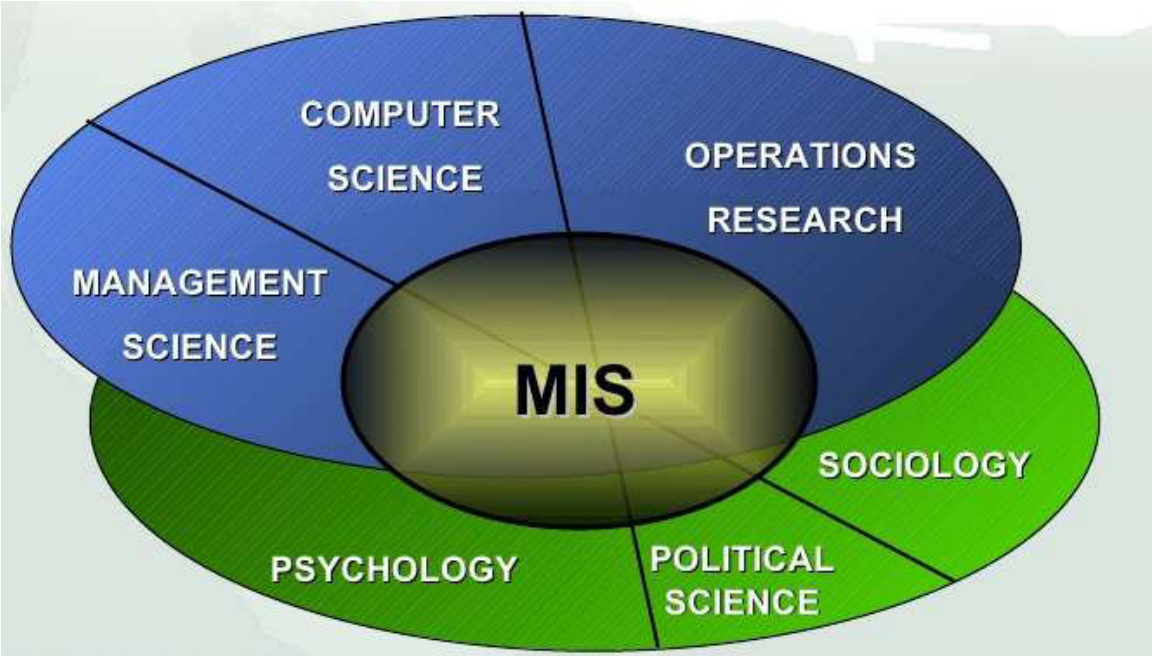
Main complementary assets for investment in information technology can be categorized into following three classes:

- → **Organizational Assets:** It includes investments in selecting appropriate business model, efficient business process, decentralization, distributed decision making rights, supportive organizational culture that values effectiveness and efficiency, Strong team for developing information systems.
- → **Managerial Assets:** It includes senior management that supports investments in new technologies and change, incentives for new management innovations, Collaborative work environment, Training programs to enhance skills of using information systems in decision making etc.

→ **Social Assets:** It includes investments in establishing internet and telecom based infrastructure, conducting and launching IT-enriched educational programs, developing standards, laws and regulations etc.

Contemporary Approaches to Information Systems

When an information system is being developed, much importance should be given to the structure of the organization, culture of the organization, etc. But along with these, especial attention should also be given to the technical side of MIS. The various contemporary approaches to MIS development are: *Technical Approach, Behavioral Approach, and Socio Technical Approach***.**



The Technical Approach

Technical approach says that all business information systems were combinations of computer science, management science, and operations research. Computer science considers knowledge of subjects like Data structures and algorithms, Database Management Systems, Computer Networking, Theory of computing, Business data processing, Programming languages, System Analysis and design etc. was essential for

designing any business information system. Management science considers theories like motivation and leadership theories and models had their impact on the information system. Operation Research Techniques such as Linear Programming, Game theory, Transportation Problem, Fuzzy logic etc helped to enhance capabilities of information systems. Business Management adopted Operation Research Techniques such as CPM & PERT for project management in the management process through information system.

Behavioral Approach

MIS also concerned with behavioral issues surrounding the development, use, and impact of information systems, which are typically discussed in the fields of *sociology, economics, and psychology*. Business Organizations are social economic groups wherein individuals work together with common motive. Every individual possesses certain values, beliefs and assumptions and have specific mind set. Therefore every individual have their influence on shaping up the information system. This social aspect influenced development of every information system and people in the world along with time e.g. e-Banking, e-Governance, e-Booking etc. **Psychology** refers to cognitive capability of human beings. The individual as well as group psychology has its own influence on the information system. People are still scared of e-Transactions like e-Payments. Study of economics plays vital role in planning and while designing of any information system. We can find out the ways for profit, growth and sales maximization as **economics** includes the study of labor, land, and investments, of money, income, and production, and of taxes and government expenditures.

Socio Technical Approach

In the socio technical view of systems, optimal organizational performance is achieved by jointly optimizing both the social and technical systems used in production. Adopting a socio technical systems perspective helps to avoid a purely technological approach to information systems. Technology must be changed and designed, sometimes even "de-optimized," to fit organizational and individual needs. Organizations and

individuals must also be changed through training, learning, and planned organizational change to allow technology to operate and prosper.

MIS Hands on Project: Sales Trend Analysis and Forecasting

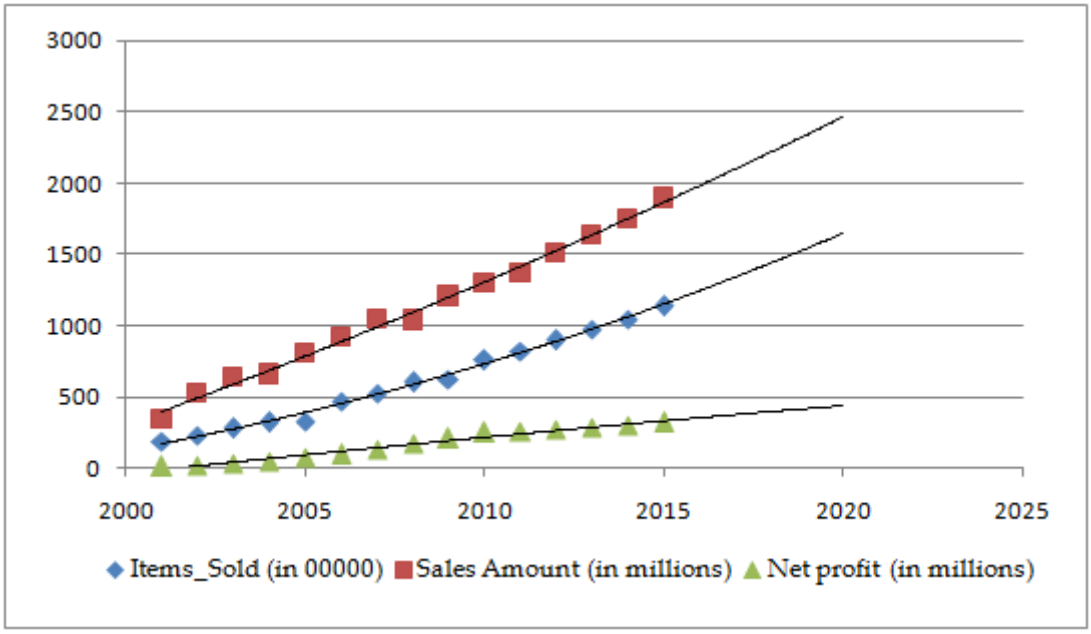
The term trend implies a change over time. One type of forecasting is quantitative, and involves analyzing time-series data, and then predicting what the future might be. For example, sales at an ice cream stand at the town park in June of each of the last five years has been good, but in July it was about 20% more than in June. If this year, the stand took in $10,000 in June (a new record), how much would you predict it will take in July? Well, if we were correct in our assumption based on the historical data, we'd estimate the July figure would be 20% higher, or $12,000.

Microsoft Excel offers some built-in tools for forecasting. One of these allows you to add a trendline to existing data points on a chart. This allows the user to interpolate (i.e., to find a data point between existing points) or to extrapolate (i.e., to find a data point past either end of the current data, either by forecasting foreword, or backcasting to an earlier period). Besides this, MS Excel provides built-in forecast function to predict future. Given the following historical data of a company, MS Excel is used to identify trend and to make prediction of upcoming five years data. Based on this prediction management can make better decisions to develop plans for future.

In the above table value of last five rows are predicted by using MS. Excels FORECAST function. The *FORECAST(x, known_y's,known_x's)* function returns the predicted value of the dependent variable (represented in the data by known_y's) for the specific value, x, of the independent variable (represented in the data by known_x's) by using a best fit (least squares) linear regression to predict y values from x values. The parameter x must have a numeric value, known_y's and known_x's must be arrays or cell ranges that contain equal numbers of numeric data values. If we plot graph for above data and add trend lines, it looks like below:

XYZ Companies Sales History, Trend Analysis and Prediction of Future Sales

Year	Items_Sold (in 00000)	Sales Amount (in millions)	Net profit (in millions)
2001	184	341	12
2002	230	523	23
2003	279	641	37
2004	324	660	51
2005	332	810	73
2006	470	915	98
2007	523	1045	132
2008	602	1040	175
2009	621	1205	211
2010	758	1295	252
2011	824	1372	260
2012	896	1506	274
2013	974	1637	289
2014	1049	1752	305
2015	1138	1894	322
2016	***1171***	***1944***	***367***
2017	***1250***	***2043***	***395***
2018	***1330***	***2151***	***422***
2019	***1409***	***2264***	***448***
2020	***1487***	***2367***	***472***



To plot this graph we can flow following steps

→ Select the historical data

→ Click insert menu and select proper scatter from it

→ Select one of the data point representing value of items sold

→ Right click on it and select add trendline option in popup menu

→ Select proper trendline options. In above graph forecast is set to 5 forward periods

→ Repeat previous step for all scatters in the plot

Chapter 2

Global E-Business and Collaboration

Business Process

Business processes refer to the manner in which work is organized, coordinated, and focused to produce a valuable product or service. Business processes also refer to the unique ways in which organizations coordinate work, information, and knowledge, and the ways in which management chooses to coordinate work. Every business can be seen as a collection of business processes. Business processes are designed to add value for the customer and should not include unnecessary activities. The outcome of a well designed business process is increased effectiveness (value for the customer) and increased efficiency (less costs for the company). There are three types of business processes:

1. **Management Processes:** The processes that govern the operation of a system. Typical management processes include corporate governance and strategic management
2. **Operational Processes:** The processes that constitute the core business and create the primary value stream. For example, taking orders from customers, and opening an account in a bank branch.
3. **Supporting Processes:** Theses processes support the core processes. Examples include Health & Safety, accounting, recruitment, call center, technical support.

The performance of a business firm depends on how well its business processes are designed and coordinated. Many business processes are tied to a specific functional area, such as sales and marketing, while others cross many different functional areas and require coordination across departments.

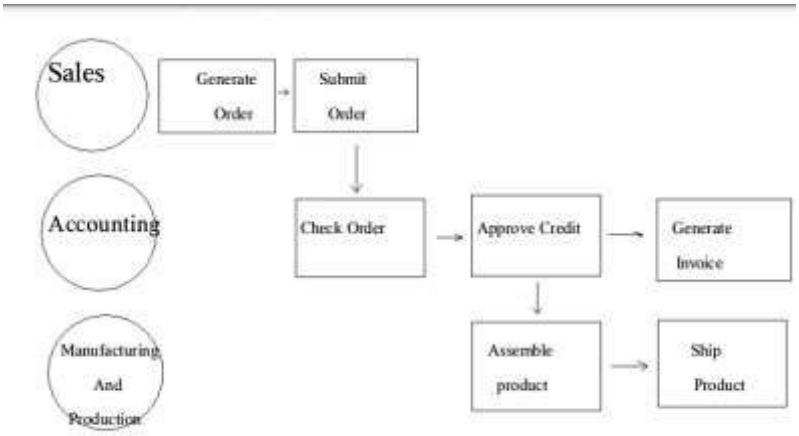


Table given below describes some typical business processes for each of the functional areas of business.

TABLE 2-1 EXAMPLES OF FUNCTIONAL BUSINESS PROCESSES

Functional Area	Business Process
Manufacturing and production	Assembling the product
	Checking for quality
	Producing bills of materials
Sales and marketing	Identifying customers
	Making customers aware of the product
	Selling the product
Finance and accounting	Paying creditors
	Creating financial statements
	Managing cash accounts
Human resources	Hiring employees
	Evaluating employees' job performance
	Enrolling employees in benefits plans

Business Processes and Information Systems

In order to operate, business must deal with many different pieces of information, they must organize work activities that use this information to operate efficiently and enhance the overall performance of the firm. Information systems make it possible for firms to manage all their information, make better decisions and improve the execution of their business processes

How Information Technology Improves Business Processes

Information systems automate many steps in business processes that were formerly performed manually. But today, information technology actually can change the flow of information even the way the business works and drive to a new business models. Information technology enhances business processes in two main ways:

- **Increasing efficiency of existing processes:** Automating steps or processes that were manual
- **Enabling entirely new processes that are capable of transforming the businesses:** This is done by **c**hanging flow of information, or by replacing sequential steps with parallel steps, or by eliminating delays in decision making

Types of Information Systems

There are different kinds of systems according to different interests, specialists, and levels in an organization. Single system cannot provide all the information needed by an organization.

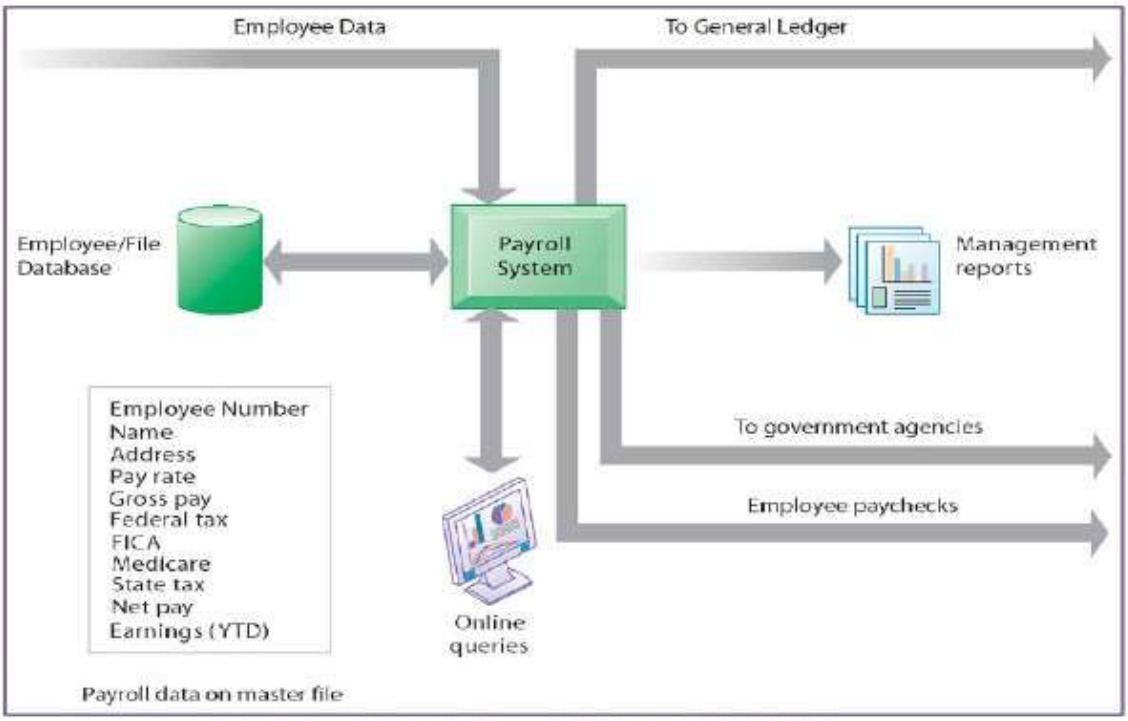
Systems for Different Management Groups

.1 The four main types of information systems that serve different management groups are: *Transaction processing systems, Management information systems, Decision support systems*, and *Executive support systems*.

Transaction Processing Systems

These are the computerized systems that perform and records the daily routine transactions necessary to conduct business. These systems serve the operational level of the organization. Some examples include sales order entry, hotel reservation systems, payroll, employee record keeping, and shipping.

Transaction processing systems are central to a business. TPS failure for a few hours can cause a firm's demise and perhaps other firms linked to it. Managers need TPS to monitor the status of internal operations and the firm's relations with external environment. TPS are also major producers of information for the other types of systems.



Online transaction processing systems (OLTPS) is an interactive data processing system that involves a direct connection between TPS programs and users. As soon as a single transaction is entered into a computer system, the program interacts immediately with the user for that transaction. It is often known as the live system where there is no time lag between data creation and its processing. A good example of this system is online ticket reservation system. Most of the OLTPS system requires the support of networks that is spread over number of organizations or branches for performing it's operations.

Unlike the OLTPS, **Batch processing** systems accumulates the transaction over a time, makes a queue of the processes depending upon the priorities and processes them periodically at the later time. Some of the TPS must follow batch processing due to business process of the organization. For example, opening an account and getting ATM card is batch processing system. In this case all requests for ATM card collected during the day time but these requests are

only processed after some hour or even if after some days. This is the reason that we need to wait some time for activating of our ATM cards.

2.Management information systems

These are the information systems at the management level of an organization and serve management-level functions like planning, controlling, and decision-making. These systems provide routine summary of reports and, in some cases, with online access to the organization's current performance and historical records to managers. Typically, these systems use internal data provided by the transaction processing systems. Normally, these systems are used for structured decision-making.

MIS usually serve managers interested in weekly, monthly, bi-monthly results—not day-to day activities. MIS generally provides answers to the routine questions that have been specified in advance and have predefined procedures for answering them.

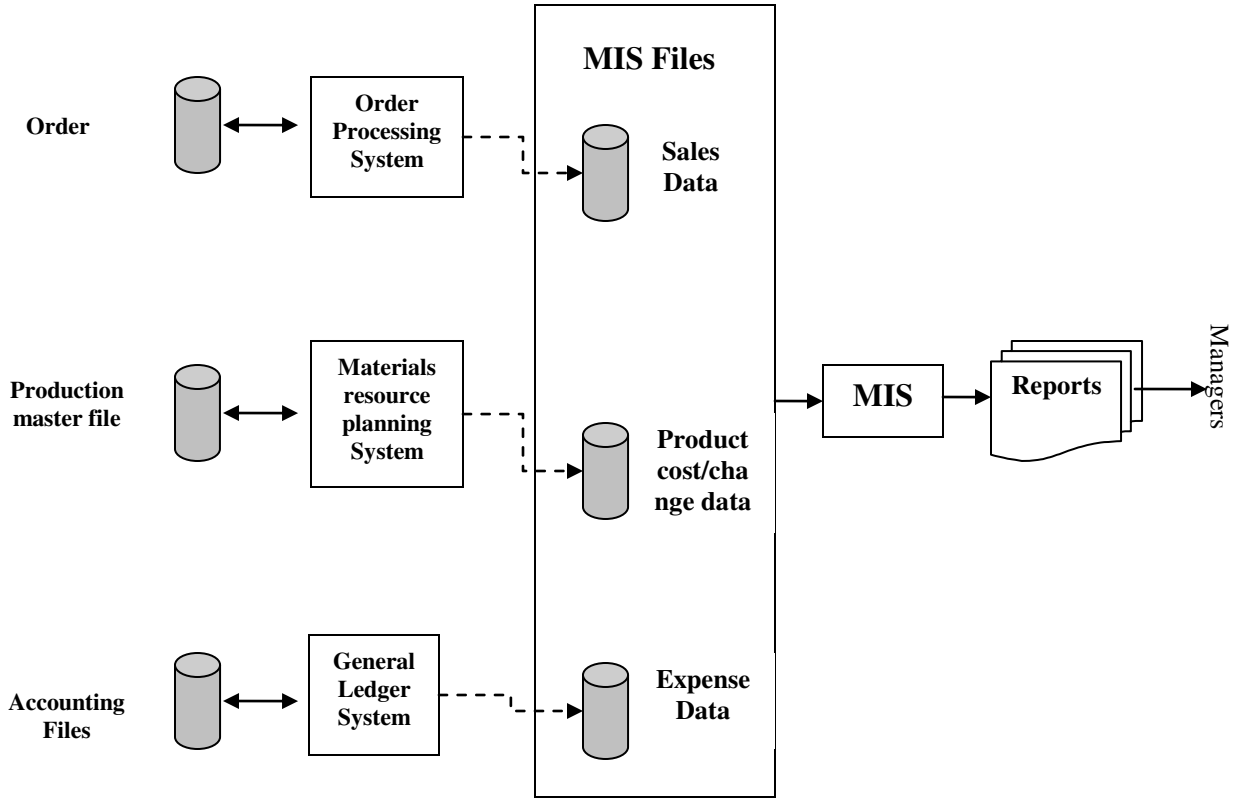


Fig: How MIS takes data from TPS

3.Decision-support systems

These systems also serve at the management level of the organization. These systems combine data and sophisticated analytical models or data analysis tools to support semi-structured and unstructured decision-making. These systems use internal information from TPS and MIS, and often information from external sources, such as current stock prices or product prices of competitors. DSS have more analytical power than other systems. DSS helps managers to make decision that are unique, fast changing and not easily specified in advance. DSS that supports and facilities the decision making process by a group is called group decision support system (GDSS). Three quantitative models often used by DSS include:

- ☞ **Sensitivity analysis** is the study of the impact that changes in one (or more) parts of the model have on other parts of the

model. Users change the value of one variable repeatedly and observe the resulting changes in other variables.

- **What-if analysis** checks the impact of a change in an assumption on the proposed solution. For example, "What will happen to the supply chain if a blizzard in Alberta reduces holding inventory from 30 percent to 10 percent?" Users repeat this analysis until they understand all the effects of various situations.
- **Goal-seeking analysis** finds the inputs necessary to achieve a goal such as a desired level of output. Instead of observing how changes in a variable affect other variables as in what-if analysis, goal-seeking analysis sets a target value (a goal) for a variable and then repeatedly changes other variables until the target value is achieved. For example, "How many customers are required to purchase a new product to increase gross profits to $5 million?"

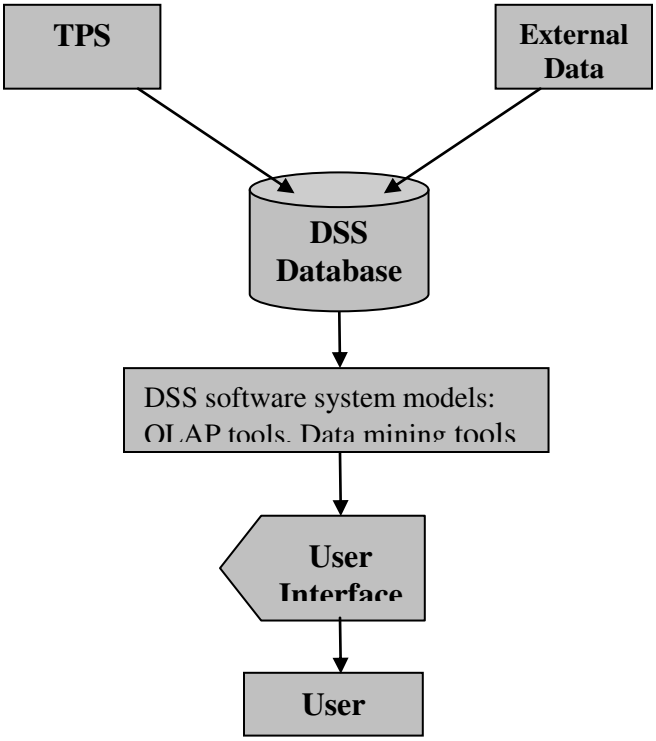
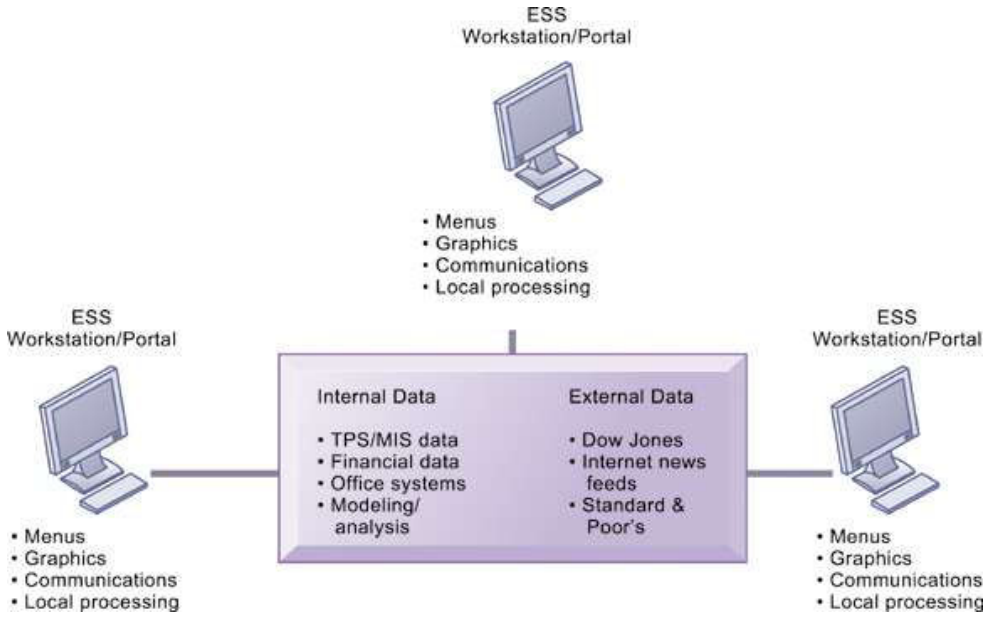


Fig: DSS and its components

4.Executive support systems

These systems serve the strategic level of the organization. These systems are designed to address unstructured decision making through advanced graphics and communication. These systems incorporate data about external events such as new tax laws or competitors, but they also draw summarized information from internal MIS and DSS.

These systems are not designed to solve a specific problem but they provide a generalized computing and telecommunication capacity that can be applied to a changing array of problems. ESS helps senior executives to monitor firm performance, spot problems, identify opportunities, and forecast trends. These systems can filter out extraneous details for high level overviews, or they can drill down to provide senior managers to detailed transaction data if required.



ESS helps senior managers to analyze, compare, and highlight trends so that they may easily monitor organizational performance or identify strategic problem and opportunities. There is less use of analytical tools (as compared to DSS) in ESS. It is not necessary for users to be an expert in computer-based information system to be

able to use them. Therefore executive system must be easy to use and the information must be easily manipulated.

Systems for Linking the Enterprise

No business can afford disjointed information systems that don't work together to produce a coherent picture of the entire organization. All the functions of a business must be integrated across traditional lines of demarcation. Islands of information can be devastating to a company if data cannot be shared throughout the company. Even worse, the islands of information can create problems if each faction of an enterprise has differing information that conflicts with other islands of information. These kinds of problems are what gave rise to **enterprise applications** that share the same data anywhere it's needed in an organization. As networks of all kinds take hold, from the Internet to intranets to extranets, Web-based enterprise applications are increasingly widespread.

Enterprise applications are the systems that can coordinate activities, decisions, and knowledge across many different functions, levels, and business units in a firm. Enterprise applications include: *enterprise systems, supply chain management systems, customer relationship management systems, and knowledge management systems.*

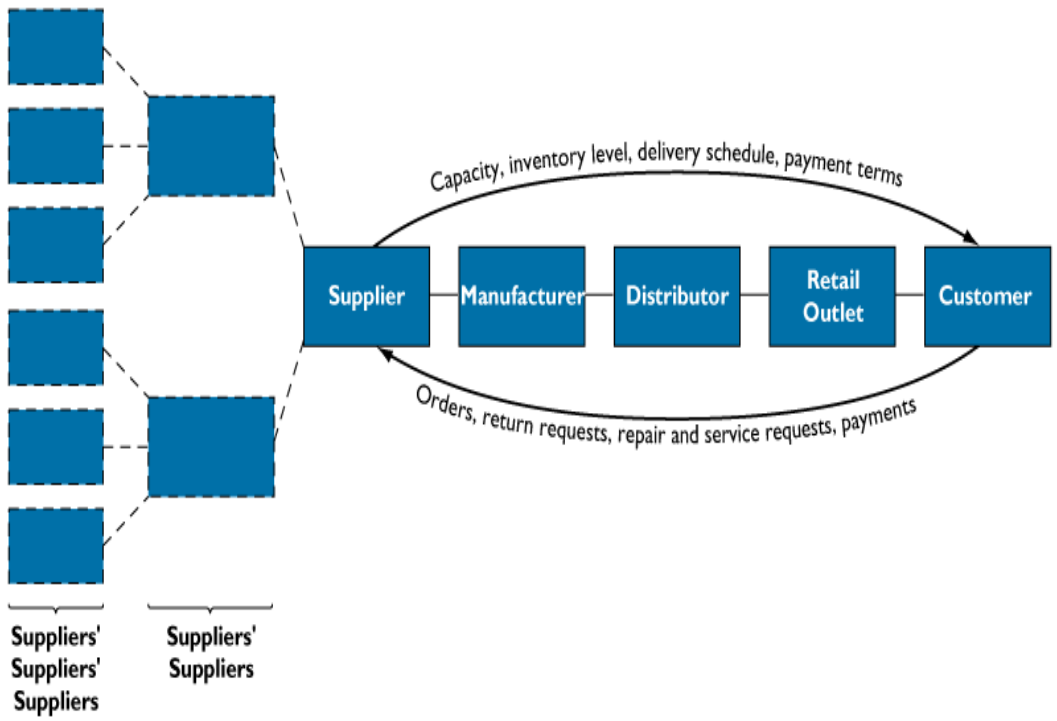
- **Enterprise systems**

These systems are also known as *enterprise resource planning (ERP)* systems and are used to bridge the communication gap between all departments and all users of information within a company. If the production department enters information about its processes, the data are available to accounting, sales, and human resources. If sales and marketing is planning a new advertising campaign, anyone anywhere within the organization will have access to that

information. Enterprise systems truly allow a company to use information as a vital resource and enhance the bottom line.

- **Supply Chain Management:**

Supply chain management is the close linkage and coordination of activities in buying, making, and moving a product. It integrates supplier, manufacturer, distributor, and customer logistics processes to reduce time, redundant effort, and inventory cost. The ***supply chain*** is a network of organizations and business processes for procuring materials, transforming raw materials into intermediate and finished products, and distributing the finished products to customers. It links suppliers, manufacturing plants, distribution centers, conveyances, retail outlets, people and information through processes such as procurement, inventory control, distribution, and delivery to supply goods and services from source through consumption. Supply chain also includes ***reverse logistics*** in which returned items flow in the reverse direction from buyer back to the seller.



Information systems make supply chain management more efficient by helping companies coordinate, schedule, and control procurement, production, inventory management, and delivery of products and services. Supply chain management systems can be built using intranets, extranets, or special supply chain management software. Information systems for supply chain management can help participants in the supply chain in the following activities:

→ Decide when and what to produce, store, and move
→ Rapidly communicate orders
→ Track the status of orders
→ Check inventory availability and monitor inventory levels
→ Reduce inventory, transportation, and warehousing costs
→ Track shipments
→ Plan production based on actual customer demand
→ Rapidly communicate changes in product design

Inaccurate or untimely information in the supply chain causes inefficiencies such as parts shortages, underutilized plant capacity,

excessive finished goods inventory, or runaway transportation costs. One recurring problem in supply chain management is the ***bullwhip effect***, in which information about the demand for a product gets distorted as it passes from one entity to next across the supply chain.

Supply chain management uses systems for *supply chain planning (SCP)* and *supply chain execution (SCE)*. ***Supply chain planning systems*** enable the firm to generate demand forecasts for a product and to develop sourcing and manufacturing plans for that product. ***Supply chain execution systems*** manage the flow of products through distribution centers and warehouses to ensure that products are delivered to the right locations in the most efficient manner.

- **Customer Relationship Management systems**

Customer relationship management (CRM) is a term that refers to practices, strategies and technologies that companies use to manage and analyze customer interactions and data throughout the customer lifecycle, with the goal of improving business relationships with customers, assisting in customer retention and driving sales growth. An information system that maintains data about customers and all their interactions with the organization is called *Customer Relation Management (CRM) System*.

A major benefit of using CRM systems is to develop better relations with existing customers, which can lead to increased sales. By better anticipating the needs of the customers businesses can predict further purchases based on past historic trends. It also allows a cross-selling of other products by highlighting and suggesting alternatives and enhancements. By implementing a CRM system it can also lead to a better marketing of products by using a target market and a more personal approach. Ultimately this could lead to enhanced customer satisfaction and retention. Ensuring a good reputation in the market allows for the company to continuously grow.

- **Knowledge Management Systems**

Knowledge management (KM) is the process of capturing, developing, sharing, and effectively using organizational knowledge. Knowledge management efforts typically focus on organizational objectives such as improved performance, competitive advantage, innovation, the sharing of lessons learned, integration and continuous improvement of the organization.

Knowledge Management System (KM System) refers to a (generally IT based) system for managing knowledge in organizations for supporting creation, capture, storage and dissemination of information. *Knowledge management systems (KMS)* collect all relevant knowledge and experience in the firm and make it available wherever and whenever it is needed to support business processes. The idea of a KM system is to enable employees to have ready access to the organization's documented base of facts, sources of information, and solutions. For example an engineer could know the metallurgical composition of an alloy that reduces sound in gear systems. Sharing this information organization wide can lead to more effective engine design and it could also lead to ideas for new or improved equipment.

Systems for Collaboration and Team Work Social Business

Globalization now allows companies to work around the clock, around the world. It's not unusual for major corporations to shift work from one time zone to another, one country to another. Somehow, the people in all the geographically-separated locations have to be able to easily communicate and share information with each other. Working in teams is now becoming the de facto practice in the business world.

What Is Collaboration?

Let's first determine exactly what the term ***collaboration*** means working with others to achieve shared and explicit goals. All members that involve in collaborative work environment focus on a particular task or mission. Collaboration and teamwork has grown in popularity over the last few years because new technology has made it much easier for people to communicate and share information, files, and documents. Collaboration and teamwork are central to the success of many businesses. Here are six reasons why businesses promote collaboration and teamwork:

- **Changing nature of work**—traditionally work was organized into silos. Now, most new jobs require interaction among employees, suppliers, and customers.
- **Growth of professional work**—most professional jobs require close coordination and sharing information and opinions with other professionals.
- **Changing organization of the firm**—traditionally organizations used a managerial hierarchy. Now, many firms have been "flattened" and expertise and decision-making powers are pushed down to groups and teams.
- **Changing scope of the firm**—globalization has created organizations that are disbursed to many geographically separated locations that require close coordination.
- **Emphasis on innovation**—innovation comes more from teams and groups than from a single individual. Collaborative practices and technologies increase the likely success of innovation.
- **Changing culture of work and business**—diverse teams tend to produce better outputs and do it faster than individuals.

Collaboration among employees, suppliers, and customers is becoming an important tool in increasing a company's competitive advantage. Social networking platforms like Facebook, Twitter, and Pinterest help improve a company's **social business** to establish and improve interactions with groups inside and outside the organization. Information sharing, innovation, and decision-making are enhanced through these technologies.

Business Benefits of Collaboration

Nearly all writers agree that collaboration is now more required within and between firms than was true in the past (for reasons outlined above).Some of the benefits of collaboration are discussed below:

- **Productivity**: People working together can complete a complex task faster than the same number of people working in isolation from one another; there will be fewer errors.
- **Quality**: People who work collaboratively can communicate errors, and take corrective actions faster, when they work together than if they worked in isolation.
- **Innovation:** People working collaboratively in groups can come up with more innovative ideas for products, services, and administration than the same number working in isolation from one another.
- **Customer Service:** People working together in teams can solve customer complaints and issues faster and more effectively than if they were working in isolation from one another.
- **Financial performance (profitability, sales, and sales growth):** As a result of all of the above, collaborative firms have superior financial performance

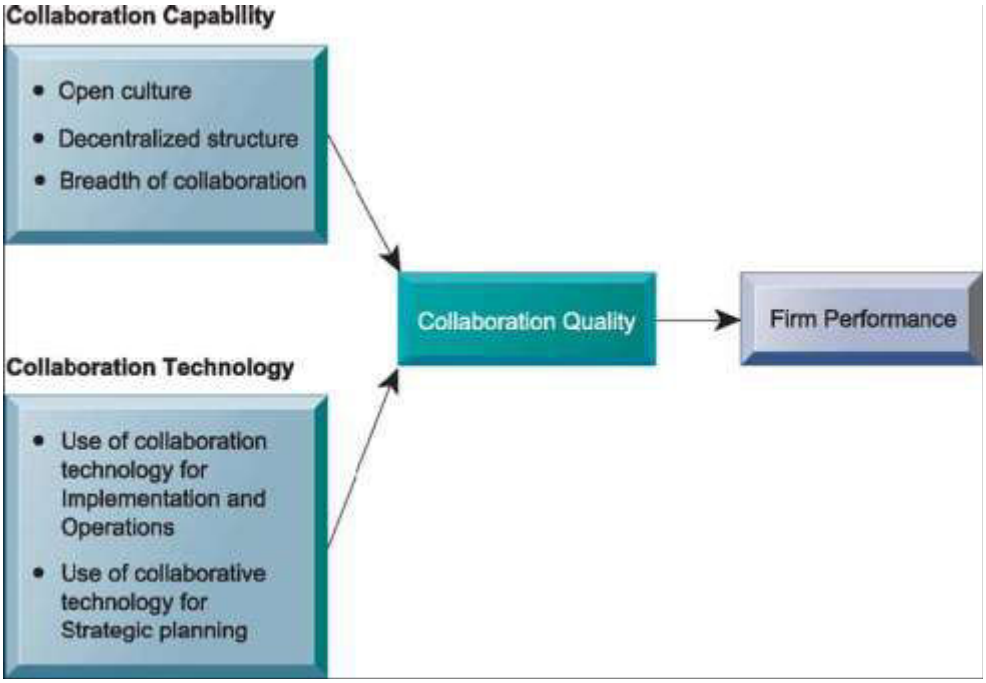


Figure: Requirements for Collaboration

Tools and Technologies for Collaboration and Social Business

Many new systems for interacting with other employees, managers, vendors, and customers have been developed. You probably use some of them without realizing how essential they've become in creating an environment that supports a collaborative culture.

- **E-mail and instant messaging:** billions of messages flow everyday between employees, managers, suppliers, and customers.
- **Social networking:** more than just a way to socialize among friends, these tools give corporations another way for users to share ideas and collaborate with each other. According to its Forrester Research survey of 1,217 business decision makers worldwide late last year, 95% use social networks to some extent.
- **Wikis**: Wikis are a type of Web site that makes it easy for users to contribute and edit text content and graphics without any knowledge of Web page development or programming

techniques. The most well-known wiki is Wikipedia. It relies on volunteers, makes no money, and accepts no advertising. Wikis are ideal tools for storing and sharing company knowledge and insights.

- **Virtual worlds:** able to house online meetings, training sessions, and lounges, this type of tool is gaining popularity as a way to meet, interact, and exchange ideas.
- **Virtual Meeting Systems:** With a virtual meeting system you can hold strategy sessions once or twice a week instead. You would feel like all of your teammates are physically located in the same place if you use **telepresence** technology. You can share ideas and documents in real-time. Best of all, you don't have all the travel hassles and you can sleep in your own bed.
- **Google Apps and Google sites:** One of the most widely used "free" online services for collaboration is Google Apps/Google Sites. Google Sites allows users to quickly create online, group-editable Web sites. Google Sites users can design and populate Web sites in minutes and, without any advanced technical skills, post a variety of files including calendars, text, spreadsheets, and videos for private, group, or public viewing and editing. Google Apps works with Google Sites and includes the typical desktop productivity office software tools (word processing, spreadsheets, presentation, contact management, messaging, and mail).
- **Microsoft SharePoint:** SharePoint is a browser-based collaboration and document management platform, combined with a powerful search engine that is installed on corporate servers. SharePoint has a Web-based interface and close integration with everyday tools such as Microsoft Office desktop software products. SharePoint software makes it possible for employees to share their Office documents and collaborate on projects using Office documents as the foundation.

- **Lotus Notes:** A third Internet-based collaboration environment your team could use is IBM's Lotus Notes. It provides all the basic collaboration tools as Google Apps/Google Sites and SharePoint do but with a few added features.

The Information Systems Function in Business

Many people focus on the job losses caused by technological advances and changes. On the other hand, many new jobs have been created because of technology. **Information systems departments,** previously a tiny group of people usually assigned to the financial group, have moved into the mainstream of most companies.

The Information Systems Department

Programmers have taken on more important positions within organizations. They must understand not only the technical side of computing, but they must also know business processes so they can adapt the technology to the needs of their company. **Systems analysts** serve as the bridge between the techies and the nontechies. Heading this group of people are the **information systems managers.** Their importance to businesses has grown as the emphasis on technology's role within organizations has grown.

Just as most organizations have a Chief Financial Officer, the position of **Chief Information Officer** has been created to handle the myriad of problems and opportunities businesses face in today's technologically driven environment. Very large corporations appoint a **Chief Security Officer** who's responsible for enforcing the firm's information security policy and training users and information systems technologists about security. The CSO keeps other executives and managers aware of security threats and maintains security tools and policies.

Chief Privacy Officer protects an organization's data from misuse and abuse and makes sure the company complies with data privacy laws. Another new position that of **Chief Knowledge Officer,** has been created in larger corporations to deal with effectively using knowledge management systems.

Organizing the Information Systems Function

Deciding how to organize the Information Systems function within a business is not as easy as deciding how to organize other functional areas. After all, sales and marketing has a much different mission than production and manufacturing. Information Systems on the other hand has similar tasks regardless of the functional area it is supporting. Sales and marketing needs access to data the same as production and manufacturing.

Larger companies and organizations develop an **IT governance** that helps decide the best way to organize the IT department for the benefit of all. Some of the issues to be decided upon are:

- Strategy and policies for using IT
- Accountability toward the organization's strategies and objectives
- How much centralization will take place within the IT function
- Does the organization receive a positive return on its IT investments?

Systems For Functional Areas

The typical information systems that support each of major business functions are: sales and marketing systems, manufacturing and production systems, finance and accounting systems, and human resources systems. These systems serve at every organizational level.

Sales and Marketing Systems

Sales and marketing function is responsible for selling the organization's products or services. **Marketing** is concerned with identifying the customers for the firm's products or services, determining what they need or want, planning and developing products and services to meet their needs, and advertising and promoting these products and services. **Sales** is concerned with contacting customers, selling the products and services, taking orders, and following up on sales. **Sales and marketing information systems** support sales and marketing activities.

These information systems are arranged by organizational level. At strategic level, these systems monitor trends affecting new products and sales opportunities, support planning for new products and services, and monitor the performance of competitors. At the management level, these systems support market research, advertising and promotional campaigns, and pricing decisions; they also analyze sales performance and the performance of the sales staff. At the knowledge level, these systems support market analysis activities. At the operational level, these systems assist in locating and contacting prospective customers, tracking sales, processing orders, and providing customer service support.

Examples of Sales and Marketing Information Systems

System	Description	Organizational Level
Order processing	Enter, process, and track orders	Operational
Pricing analysis	Determine prices for products and services	Management
Sales trend forecasting	Prepare 5-year sales forecasts	Strategic

Manufacturing and Production Systems:

The manufacturing and production function is responsible for producing firm's goods and services. Manufacturing and production is concerned with the planning, development, and maintenance of

production facilities; the establishment of production goals; the acquisition, storage, and availability of production materials; and scheduling of equipment, facilities, materials, and labor required to fashion finished products. **Manufacturing and production information systems** support manufacturing and production activities.

Examples of Manufacturing and Production Information Systems

System	Description	Organizational Level
Machine control	Control the actions of machines and equipment	Operational
Production planning	Decide when and how many products should be produced	Management
Facilities location	Decide where to locate new production facilities	Strategic

These information systems are also arranged by organizational level. At the strategic level, these systems deal with the firm's long term manufacturing goals, such as where to locate new plants or whether to invest in new manufacturing technology. At the management level, these systems analyze and monitor manufacturing and production costs and resources. At knowledge level, these systems deal with creating and distributing design knowledge or expertise to drive the production process. At the operational level, these systems deal with the status of production tasks.

Finance and Accounting Systems

The **financial** function is responsible for managing the firm's financial assets, such as cash, stocks, bonds, and other investments in order to maximize the return on these financial assets. It also manages the capitalization of the firm (finding new financial assets in stocks, bonds, or other forms of debt). The finance function must also obtain a considerable amount of information from sources external to the firm in order to determine whether the firm is getting the best return on investments.

The **account** function is responsible for maintaining and managing the firm's financial records (such as receipts, disbursement, depreciation, payroll) to account for the flow of funds in the firm. **Finance and accounting information systems** support finance and accounting activities.

Examples of Finance and Accounting Information Systems

System	Description	Organizational Level
Accounts receivable	Tracks money owed the firm	Operational
Budgeting	Prepares short-term budgets	Management
Profit planning	Plans long-term profits	Strategic

These information systems are also arranged by organizational level. At the strategic level, these systems establish long-term investment goals for the firm and provide long-range forecasts of the firm's financial performance. At the management level, these systems help managers oversee and control the firm's financial resources. At the knowledge level, these systems support finance and accounting by providing analytical tools and workstations for designing the right mix of investments to maximize returns for the firm. At the operational level, these systems track the flow of funds in the firm through transactions.

Human Resources Systems:

The human resource function is responsible for attracting, developing, and maintaining the firm's work force. This function support activities such as identifying potential employees, maintaining complete record on existing employees, and creating programs to develop employees' talent and skills. **Human resources information systems** support these activities.

Examples of Human Resources Information Systems

System	Description	Organizational Level
Training and development	Tracks employee training, skills, and performance appraisals	Operational
Compensation analysis	Monitors the range and distribution of employee wages, salaries, and benefits	Management
Human resources planning	Plans the long-term labor force needs of the organization	Strategic

These information systems are also arranged by organizational level. At the strategic level, these systems identify the manpower requirements (skills, educational level, types of position, number of positions, and cost) for meeting the firm's long-term business plans. At the management level, these systems help managers monitor and analyze the recruitment, allocation, and compensation of employees. At the knowledge level, these systems support analysis activities related to job design, training, and the modeling of employee career paths and reporting relationships. At the operational level, these systems track the recruitment and placement of the firm's employees.

Chapter 3
Information Systems, Organizations, and Strategy

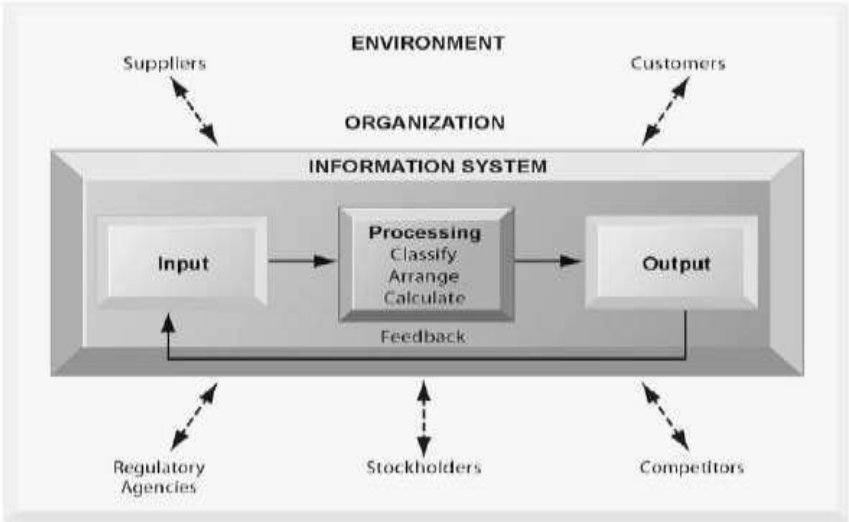
Organizations and Information Systems

Relationship between information systems and organization is like chicken-and-egg theory. We need to design information systems that serve the existing organization. At the same time we must be ready and willing to restructure the organization to take advantage of the improvements an information system can offer. So which one takes precedent—the organization or the information system? Actually neither one. The goal is to adapt one to the other.

What Is an Organization?

An **organization** is very similar to the information system. Refer to the figures given below:

FIGURE 1-4 FUNCTIONS OF AN INFORMATION SYSTEM



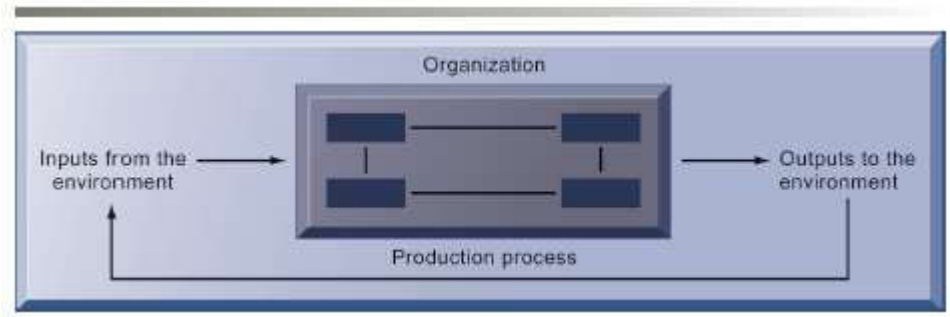


Figure: The Technical Microeconomic Definition of the Organization

These two figures have many things in common. Both information systems and organizations require inputs and some sort of processing, both have outputs, and both depend on feedback for successful completion of the loop. Information systems use data as their main ingredient and organizations rely on people. However, the similarities are remarkable. Both are a structured method of turning raw products (data/people) into useful entities (information/producers).

Features of Organizations

The class you're enrolled in is an organization of sorts, isn't it? Think about it—how many of the following characteristics fit your class? How many fit any organization you're in?

- Clear division of labor
- Hierarchy of authority
- Abstract rules and procedures
- Impartial judgments
- Technical qualifications for positions
- Maximum organizational efficiency

These characteristics describe organizations that are called bureaucracies.

Organizational Structure

Table given below shows some common organizational structures.

TABLE 3-2 ORGANIZATIONAL STRUCTURES

ORGANIZATIONAL TYPE	DESCRIPTION	EXAMPLES
Entrepreneurial structure	Young, small firm in a fast-changing environment. It has a simple structure and is managed by an entrepreneur serving as its single chief executive officer.	Small start-up business
Machine bureaucracy	Large bureaucracy existing in a slowly changing environment, producing standard products. It is dominated by a centralized management team and centralized decision making.	Midsize manufacturing firm
Divisionalized bureaucracy	Combination of multiple machine bureaucracies, each producing a different product or service, all topped by one central headquarters.	Fortune 500 firms, such as General Motors
Professional bureaucracy	Knowledge-based organization where goods and services depend on the expertise and knowledge of professionals. Dominated by department heads with weak centralized authority.	Law firms, school systems, hospitals
Adhocracy	Task force organization that must respond to rapidly changing environments. Consists of large groups of specialists organized into short-lived multidisciplinary teams and has weak central management.	Consulting firms, such as the Rand Corporation

How Information Systems Impact Organizations and Business Firms

Two major types of theories about how information systems affect organizations are: economic theories and behavioral theories.

Economic Impacts

It's sometimes cheaper to hire a computer than to hire a person. To better illustrate this concept, let's take a look at how a company can find it cheaper to use an information system to develop and disseminate a Human Resources policy for employee dress codes. The HR assistant may write the first draft of the policy and give it to the HR director on paper. The director will review it and make changes. The assistant then must incorporate the changes and reprint the document. If there is an information system, the assistant can submit the draft to the director electronically and the director can make changes to the electronic version of the file and return it to the assistant. This will reduce time and cost of the task.

Of course others in the organization must review the new dress code policy. The proposed policy can be printed in 15 copies, a person can manually send the copies out, track who they went to and when, and then track all the changes made to the proposal. If we use information systems, the proposed policy can be sent electronically to reviewers who will electronically collaborate on necessary changes. Each of the reviewers can see what the others think and the changes they would like to make. This is another point where we can huge amount of human effort and some amount of time and money also. One manager can oversee ten employees (agents) rather than four employees because information is cheaper and easier to disseminate.

Organizational and Behavioral Impacts

IT Flattens Organizations

Rather than five layers of management in an organization, information technology allows companies to flatten the layers to three, maybe even two. Here's how:

- IT pushes decision-making rights lower in the organization because lower-level employees receive the information they need to make decisions without supervision.
- Managers now receive so much more accurate information on time, they become much faster at making decisions, so fewer managers are required.
- Management costs decline as a percentage of revenues, and the hierarchy becomes much more efficient.

The Internet and Organizations

The example used earlier of posting personnel policies to the company intranet is just one small example of how businesses are using network technologies to reduce costs and enhance their business processes. Business-to-business commerce is growing at a tremendous pace because of the cost savings the Internet allows. *The Internet provides an open platform technology that allows transaction processing between businesses at much cheaper costs and provides an easy-to-use interface.* The innovative ways organizations are using the Internet, intranets, and extranets to improve their business processes and lower costs is simply fascinating.

Using Information Systems to Achieve Competitive Advantage

Porter's Competitive Forces Model

Porter's **competitive forces model** tells that much of the success or failure of a business depends on its ability to respond to its external environment. Figure below shows five external forces that every business must contend with at one time or another.

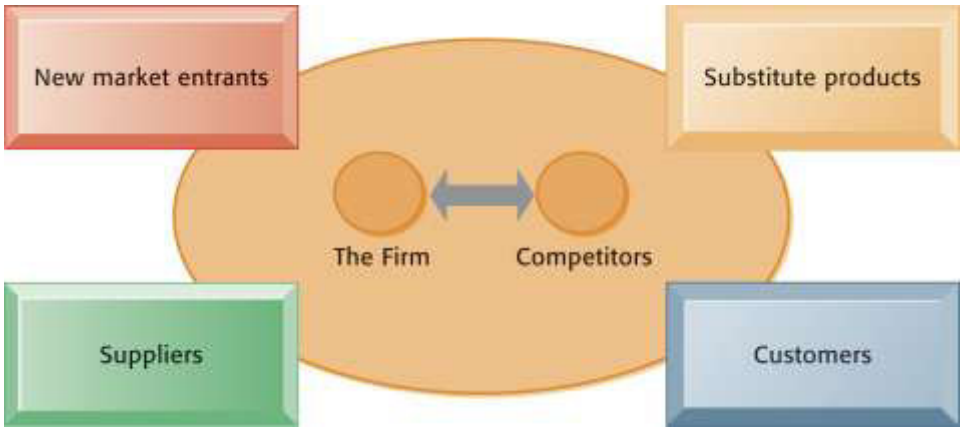


Figure: Porter's Competitive Forces Model

It's important to understand from this model that a firm's success is not predicated on how well it does internally. It must also pay attention to:

- **Traditional competitors:** Always trying to steal your customers with new products and services.
- **New market entrants:** Not constrained by traditional ways of producing goods and services, they can easily jump into our markets and steal customers away with cheaper or better products and services.
- **Substitute products and services:** Customers may be willing to try substitute products and services if they decide our price is too high or the quality of our products and services is too low.
- **Customers:** They are now armed with new information resources that make it easier for them to jump to our competitors, new market entrants, or substitute products.
- **Suppliers:** The number of suppliers used may determine how easy or difficult our business will have in controlling our supply chain. Too few suppliers and you lose a lot of control.

Information System Strategies for Dealing with Competitive Forces

Many companies have found that effective and efficient information systems allow them to deal with external forces in one of four ways: low-cost leadership, product differentiation, focus on market niche, and strengthen customer and supplier intimacy.

Low-Cost Leadership

By using information systems to lower our operational costs we can lower our prices. That will make it difficult for traditional competitors and new market entrants to match our prices.

Product Differentiation

A very effective use of strategic information systems is to create products or services that are so different that they create barriers for the competition. **Product differentiation** is at the heart of Apple Computer's success. People like to feel that they are unique individuals with their own needs and desires. One of the best strategies for dealing with competitors is to offer customers exactly what they want, when they want it, and how they want it. The Internet provides a new outlet for **mass customization** by allowing customers to order one-of-a-kind products.

Focus on Market Niche

If an organization is in a tough competitive market, it can choose to focus on a very narrow segment of the market rather than a broad general audience. A firm can gather very specific information about its customers using data mining techniques. Then it creates a focused differentiation business strategy to market directly to those consumers. Apple Computer uses focused differentiation to help sell its computers to a narrow target market of graphic designers and educators rather than the general population of computer users.

Strengthen Customer and Supplier Intimacy

Supply chain management (SCM) systems increase supplier intimacy while customer relationship management systems increase customer intimacy. SCM systems create immense **switching costs** between a company and its suppliers because of the investment of hardware and software necessary to make the system successful. Customer relationship management systems allow companies to learn details about customers that give them the competitive advantage over traditional competitors and new market entrants.

The Internet's Impact on Competitive Advantage

The Internet allows traditional competitors to introduce new products and services and attract customers. It provides a low cost avenue for new market entrants. Consumers can easily and quickly find substitute products and services through the Internet. Customers can use information provided on the Internet to create new competition between companies while suppliers can increase their market power. Table below summarizes the impact the Internet is having on many industries.

TABLE 3-5 IMPACT OF THE INTERNET ON COMPETITIVE FORCES AND INDUSTRY STRUCTURE

COMPETITIVE FORCE	IMPACT OF THE INTERNET
Substitute products or services	Enables new substitutes to emerge with new approaches to meeting needs and performing functions
Customers' bargaining power	Availability of global price and product information shifts bargaining power to customers
Suppliers' bargaining power	Procurement over the Internet tends to raise bargaining power over suppliers; suppliers can also benefit from reduced barriers to entry and from the elimination of distributors and other intermediaries standing between them and their users
Threat of new entrants	The Internet reduces barriers to entry, such as the need for a sales force, access to channels, and physical assets; it provides a technology for driving business processes that makes other things easier to do
Positioning and rivalry among existing competitors	Widens the geographic market, increasing the number of competitors, and reducing differences among competitors; makes it more difficult to sustain operational advantages; puts pressure to compete on price

Because of the tremendous growth of the Internet and its influence on all five elements of Porter's model, businesses must continually monitor the organizational environment, especially the external environment for potential challenges and opportunities. Those businesses that adapt their business model stand a chance of success. Those businesses who ignore the environmental changes and remain stagnant, risk everything they have.

The Business Value Chain Model

A **value chain** is a set of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service for the market. Porter described a chain of activities common to all businesses, and he divided them into primary and support activities, as shown below.

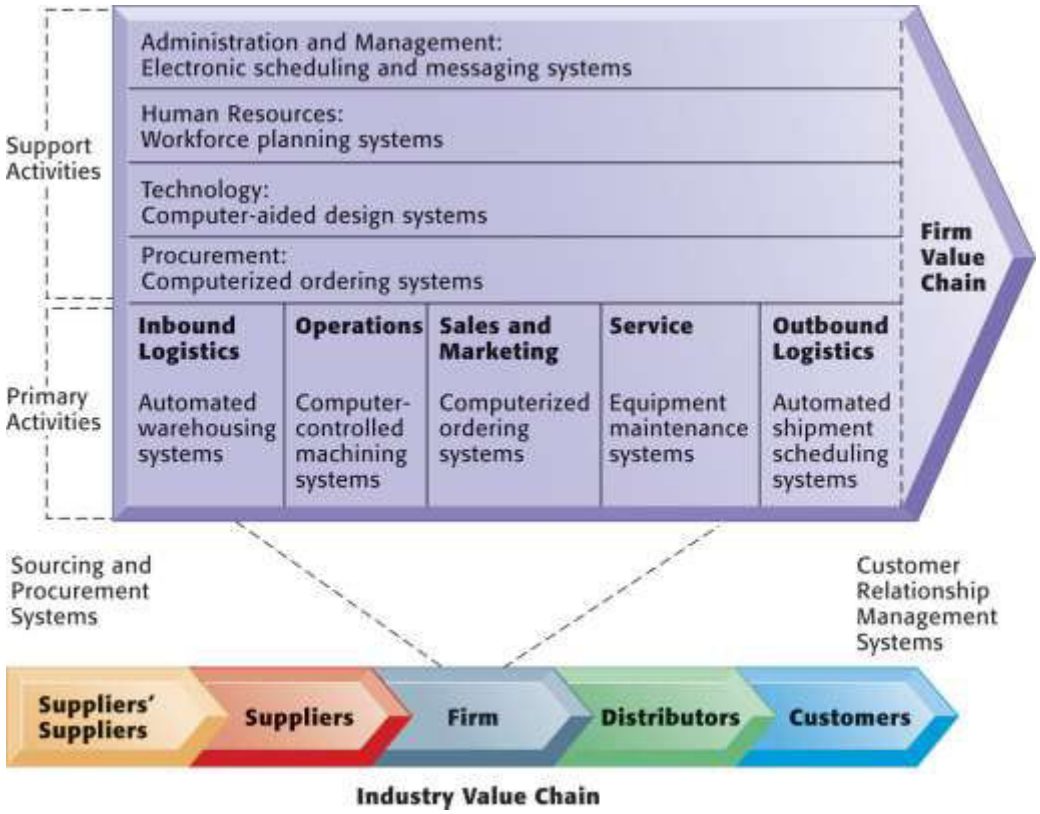


Figure The Value Chain Model

❖ Primary Activities

Primary activities relate directly to the physical creation, sale, maintenance and support of a product or service. They consist of the following:

- **Inbound logistics –** These are all the processes related to receiving, storing, and distributing inputs internally. Your supplier relationships are a key factor in creating value here.

- **Operations –** These are the transformation activities that change inputs into outputs that are sold to customers. Here, your operational systems create value.

- **Outbound logistics –** These activities deliver your product or service to your customer. These are things like collection, storage, and distribution systems, and they may be internal or external to your organization.

- **Marketing and sales –** These are the processes you use to persuade clients to purchase from you instead of your competitors. The benefits you offer, and how well you communicate them, are sources of value here.

- **Service –** These are the activities related to maintaining the value of your product or service to your customers, once it's been purchased.

  - **Support Activities**

These activities support the primary functions above. In our diagram, the dotted lines show that each support, or secondary, activity can play a role in each primary activity. For example, procurement supports operations with certain activities, but it also supports marketing and sales with other activities.

- **Procurement (purchasing) –** This is what the organization does to get the resources it needs to operate. This includes finding vendors and negotiating best prices.

- **Human resource management –** This is how well a company recruits, hires, trains, motivates, rewards, and retains its workers. People are a significant source of value, so businesses can create a clear advantage with good HR practices.

- **Technological development –** These activities relate to managing and processing information, as well as protecting a company's knowledge base. Minimizing information technology costs, staying current with technological advances, and maintaining technical excellence are sources of value creation.

- **Infrastructure –** These are a company's support systems, and the functions that allow it to maintain daily operations. Accounting, legal, administrative, and general management are examples of necessary infrastructure that businesses can use to their advantage.

By effectively using an information system in a strategic role at any, or preferably all, levels of the organization, a digital firm can provide more value in their products than the competition. If they can't provide more value, then the strategic information system should help them provide the same value but at a lower price.

Using Systems for Competitive Advantage: Management Issues

Strategic information systems often change the organization as well as its products, services, and operating procedures, driving the organization into new behavioral patterns. Successfully using information systems to achieve a

competitive advantage is challenging and requires precise coordination of technology, organizations, and management.

Sustaining Competitive Advantage

Using information systems to beat the competition and increase the value of a product is not easy. Because competitors can quickly copy strategic systems, competitive advantage is not always sustainable. Sustaining a competitive advantage constantly requires changing processes and methods of conducting business. Managers simply cannot rest on their success with today's fast paced, fast changing technological advances. Technology changes much faster than organizations can adapt. As soon as employees and managers become comfortable with a particular system, it's almost time to make some more changes.

Aligning IT with Business Objectives

It's such a basic idea—an organization should align its information technology with its business objectives. It's an easy thing to have happen when the techies and the non-techies fail to work together to plan, implement, and maintain information systems that support their company's business objectives and competitive strategy.

Employees and managers in all the functional areas must be active players in the IT game. They can't sit on the sidelines and let someone else decide what kind of information system the company will have. They can't claim ignorance and say they don't know that much about computers.

Managing Strategic Transitions

A vital attribute of any manager's success is the ability to adapt to change. The pace of technological change is at its highest level ever. With each advance, the organization must use **strategic transitions,** to take its advantage. Making changes in the information systems should trigger a review of associated processes to make sure they are in sync.

Chapter 5
Information Technology Infrastructure

Overview

Information technology is the application of computers and telecommunication equipments to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise. The term is commonly used as a synonym for computers and computer networks, but it also encompasses other information distribution technologies such as television and telephones. Humans have been storing, retrieving, manipulating and communicating information since the Sumerians in Mesopotamia developed writing in about 3000 BC, but the term *information technology* in its modern sense first appeared in a 1958 article published in the Harvard Business Review; authors Harold J. Leavitt and Thomas L.

As information becomes a valuable resource of a digital firm, the infrastructure used to care for it is also considered as valuable resource of an organization. This Chapter will examine all of the components that comprise todays and tomorrow's IT infrastructure and how it can be managed in best way.

What is IT Infrastructure?

IT infrastructure refers to the composite hardware, software, network resources and services required for the existence, operation and management of an enterprise IT environment. It allows an organization to deliver IT solutions and services to its employees, partners and customers and is usually internal to an organization and deployed within owned facilities. Typically, a standard IT infrastructure consists of the following components:

- Hardware: Servers, computers, data centers, switches, hubs and routers, etc.
- Software: Enterprise resource planning (ERP), customer relationship management (CRM), productivity applications and more.
- Network: Network enablement, Internet connectivity, firewall and security.
- Persware: Human users, such as network administrators, developers, designers and generic end users with access to any IT appliance or service are also part of an IT infrastructure, specifically with the advent of user-centric IT service development.

To round out the list of IT infrastructure components we need to add the following services to computing hardware and software:

- Computing services: Provide platforms that ensure a coherent digital environment
- Telecommunications services: Determine appropriate data, voice, and video that connect employees, customers, and suppliers
- Data management services: Not just store, but manage massive amounts of corporate data and make it available for users to analyze
- Application software services: Enterprise resource planning, customer relationship management, supply chain management and knowledge management systems
- Physical facilities management services: Physical installation of computing, telecommunications, and data management services
- IT management services: Plan and develop infrastructures, coordinate IT services among business units, account for IT expenditure, and provide project management services
- IT standards services: Develop policies that ensure interoperability of all IT infrastructure components
- IT education services: Train employees to properly use IT investments and educate managers about planning for and managing the investments
- IT research and development services: Research future IT projects and investments

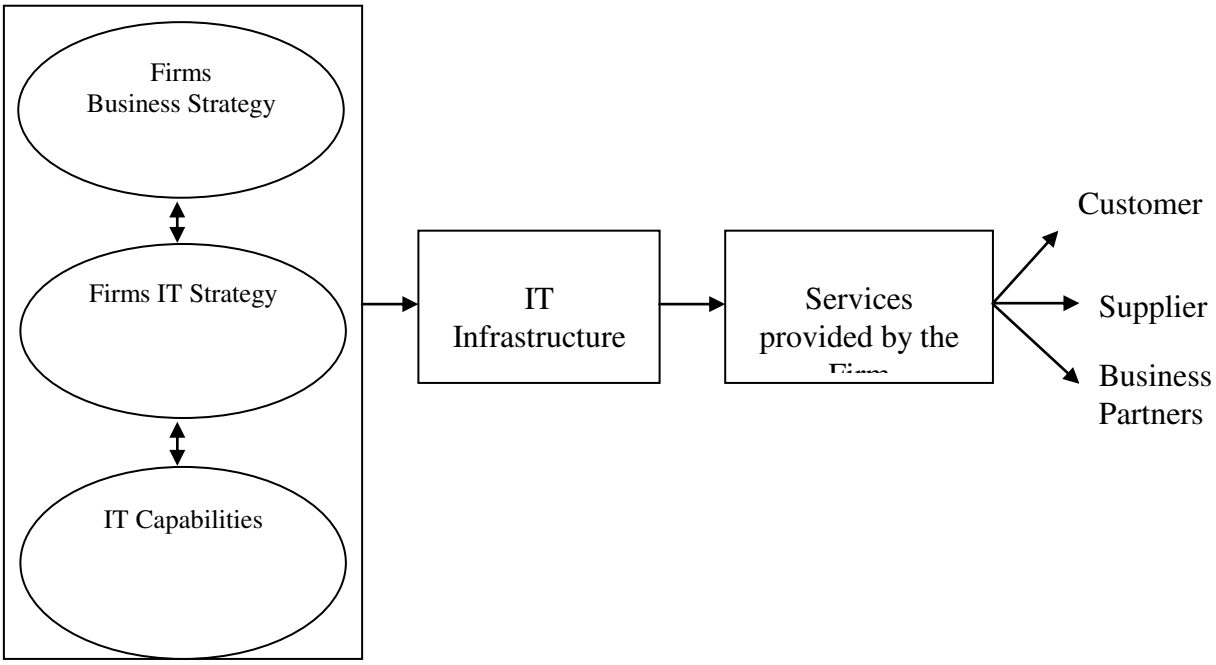


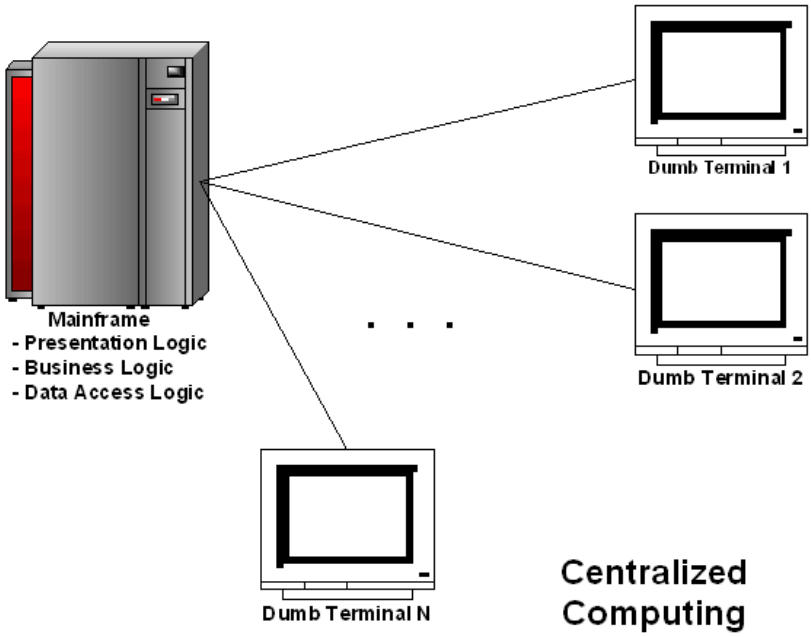
Fig: Connection between Firm, IT Infrastructure and Business Capabilities

Evolution of IT Infrastructure

Reviewing the evolution of corporate IT infrastructure offers some insight into where we may be headed. Five stages in the evolution of IT infrastructure can be identified. Which are described below:

General-purpose mainframe and minicomputer era (1959 to present)

The introduction and continued use of mainframes. Mainframes were the first powerful computers that could provide time sharing, multi tasking, and virtual memory, and became powerful enough to support thousands of remote terminals. The mainframe era was a period of highly centralized computing controlled by programmers and system operators. In this era dumb terminals were normally connected with centralized computing facilities. Minicomputers are, powerful yet less expensive computers, began to change this pattern, allowing decentralized computing customizable to individual departments or business units. It's interesting to note that IBM began this era and remains the sole supplier of mainframe computing. Although the experts and pundits predicted the death of mainframes in the mid-1980s, they have evolved and remain a strong, viable component in many IT infrastructures because of their ability to store and process huge amounts of data and transmissions



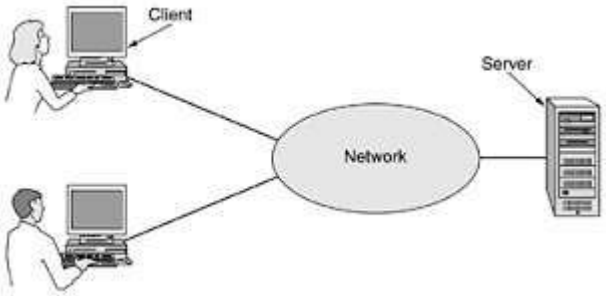
Personal computer era (1981 to present)

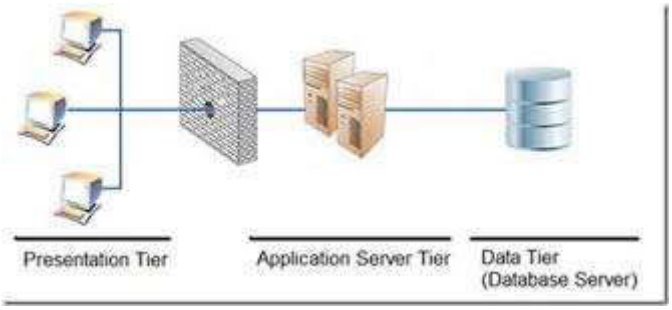
The appearance of the IBM PC in 1981 is usually considered the beginning of the PC era. Advances developed for personal computers in the home have given rise to much of the advances in corporate computing in the last 25 years. As the home

user became more comfortable with using computers, and more applications were developed for personal computers, employees demanded increased use of computers in the workplace. While the **Wintel PC** standard has dominated this era, open-source software is starting to put a big dent into that stronghold.

Client/server era (1983 to present)

In client/server computing, desktop or laptop computers called clients are networked to server computers that provide the clients with services and capabilities. Computer processing work is split between these two types of machines. The client is the user point of entry, whereas the server typically processes and stores shared data, serves up Web pages, or manages network activities. The term server refers to both the software application and the physical computer on which the network software runs. The server could be a mainframe, but today server computers typically are more powerful versions of personal computers. In two-tiered client/server architecture, a client computer is networked to a server with processing split between the two. In multi-tiered (N-tier) client/server architecture, the work of the entire network is balanced over several different levels of servers. Distributing work across a number of smaller inexpensive machines cost much less than minicomputers or mainframes.





Enterprise computing era (1992 to present)

The Internet networking technology Transmission Control Protocol/Internet Protocol (TCP/IP) suite enables enterprises to link disparate devices and local area networks (LANs) into single enterprise-wide networks. Integrated computing environments allows for much faster and seamless gathering and distribution of data. Perhaps no other era has seen the explosive growth in functionality and popularity as this era. The problems created by proprietary, closed systems are being solved by the standards and open-source software created in this era.

Cloud and mobile computing era (2000 to Present)

Cloud computing is defined as a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications. Cloud computing enables companies to consume compute

resources as a utility -- just like electricity -- rather than having to build and maintain computing infrastructures in-house. Cloud computing promises several attractive benefits for businesses and end users. Three of the main benefits of cloud computing includes:

→ **Self-service Provisioning**: End users can spin up computing resources for almost any type of workload on-demand.

→ **Elasticity**: Companies can scale up as computing needs increase and then scale down again as demands decrease.

→ **Pay per use**: Computing resources are measured at a granular level, allowing users to pay only for the resources and workloads they use.

Technology Drivers of Infrastructure Evolution

There are five important features or characteristics of information technology today that act as drivers toward the expansion and further development of technology. These include:

Moore's Law and Microprocessing Power

Moore's Law states that microprocessing power doubles in every two years. Variations of this law assert that

- Microprocessing power doubles in every 18 months
- Computer power doubles in every 18 months
- The price of computing falls by half in every 18 months.

Perhaps no other law holds as much weight in the evolution of computers as Moore's Law. Microprocessor chips using transistors have helped increase computing power exponentially. At the same time packing more transistors into less space has driven down transistor cost dramatically as well as the cost of the products in which they are used. An Intel® processors today can contain as

many as 1 billion transistors, run at 3.2 GHz and higher, deliver over 10,000 MIPS, and can be manufactured in high volumes with transistors that cost less than 1/10,000th of a cent.

Nanotechnology uses individual atoms and molecules to create computer chips thousands of times smaller than current technologies permit. Nanotubes have potential uses as minuscule wires or in ultrasmall electronic devices. Other technologies promise to further miniaturize transistors and improve chip technology.

The Law of Mass Digital Storage

The Law of Mass Digital Storage states that while the amount of digital information produced worldwide doubles every year, the cost of storing digital information is falling at an exponential rate. In the early evolution of computing, storage needs were based on written text. Now we need the extra storage for photos, music, and video. From 1980 to 1990, hard disk drive capacities for PCs grew at the rate of 25 percent annual compound growth, but after 1990, growth accelerated to more than 65 percent each year.

Metcalfe's Law and Network Economics

Metcalfe's Law described the value of a network grows exponentially with each increase in membership to the network. Demand for information technology has been driven by the social and business value of digital networks, which rapidly multiply the number of actual and potential links among network members. If you build a network for ten users, you'll spend the necessary money for the basic equipment. If you already have the equipment in place, you can add one more user at nominal costs. However, the additional user will bring value to the network far beyond what it costs to add him/her.

Declining Communications Costs and the Internet

One of the biggest drivers in the exploding use of computers is directly attributable to the Internet. It's getting cheaper every day to connect to the Internet because of declining communication costs. As more and more users connect to the Internet, businesses must find ways to meet the expectations and demands of users, especially in the area of mobile computing devices.

The rapid decline of communication costs and the exponential growth in size of

Standards and Network Effects

Technology Standards and specifications establish the compatibility of products and the ability to communicate in a network, unleash powerful economies of scale and result in price declines as manufacturers focus on products built to a certain standard. Some of the important standards that have shaped IT infrastructure include ASCII, UNIX, TCP/IP, Ethernet, the IBM/Microsoft/Intel Personal Computer, and the World Wide Web.

ASCII stands for American standard code for information interchange and made it possible to exchange data among computers developed by different manufacturers. **UNIX** is an open source multitasking operating system that is used by variety by computers developed by different manufacturers. **TCP/IP** stands for transmission control protocol/internet protocol and is a suit of communication protocols that defines common language for establishing communication between different computers attached in a network. Ethernet enables desktop computers to local area networks. IBM/Microsoft/Intel Personal Computer is the standard Wintel design for personal computers based on Intel processors and other devices and Microsoft Windows operating systems.

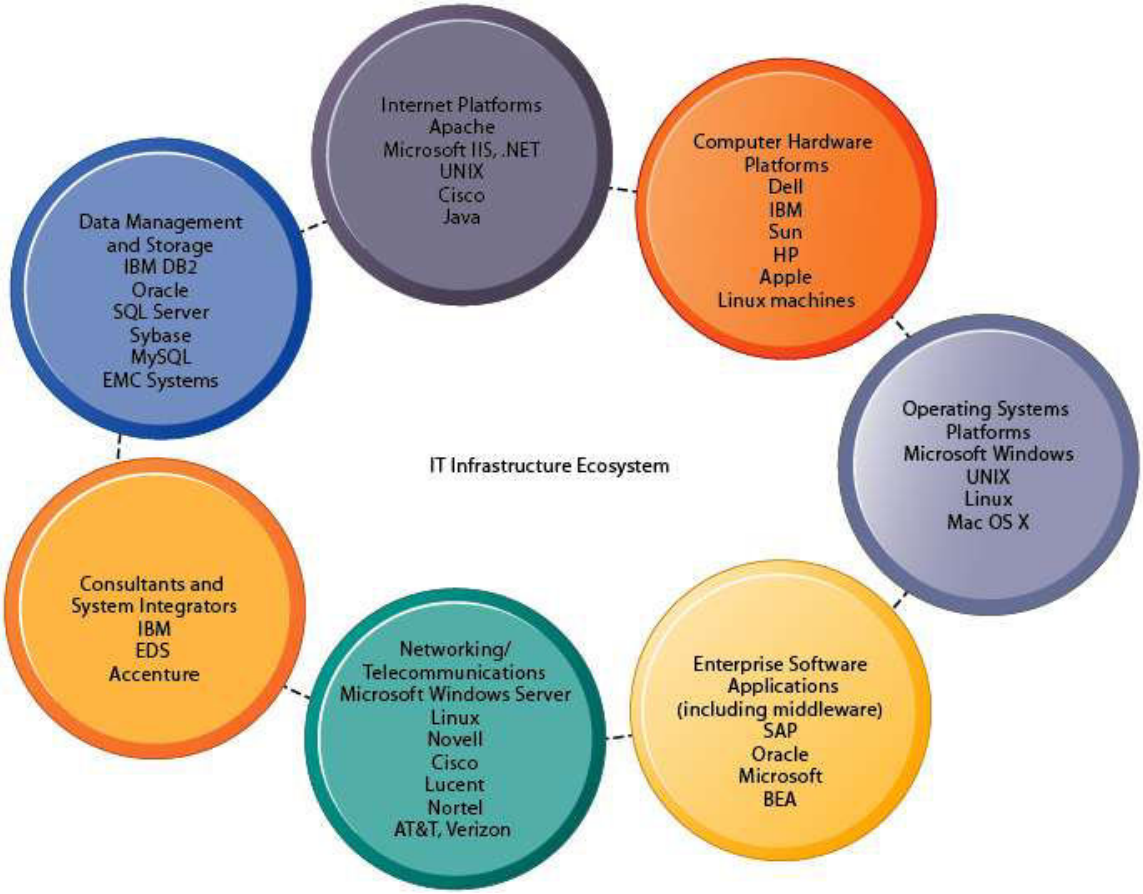
Infrastructure Components

In the early days of personal computers, the printer you had your eye on may not have worked with your brand of computers. You had to buy a scanner built specifically for your computer. You couldn't connect to the Internet unless you had the correct modem for your Internet Service Provider. The evolution we are now experiencing is aiming to fix these problems and make computing ubiquitous anytime, anywhere. IT infrastructure is composed of seven major components that aim to achieve above mentioned goal.

1. **Computer Hardware Platforms**: It includes client machines and server machines, as well as modern main frames produced by IBM. Blade Servers are ultrathin servers, intended for a single dedicated application, and are mounted in space-saving racks.
2. **Operating System Platforms:** It includes platforms for client computers, dominated by Windows operating systems, and servers, dominated by the various forms of the UNIX operating system or Linux. Operating

Systems are software that manage the resources and activities of the computer and act as an interface for the user.

3. **Enterprise and Other Software Applications:** It includes SAP, Oracle, and PeopleSoft, and middleware software that are used to link a firm's existing application systems.
4. **Data Management and Storage:** It is handled by database management software and storage devices include traditional storage methods, such as disk arrays and tape libraries, and newer network-based storage technologies such as storage area networks (SANs). It is the network that connects multiple storage devices on dedicated high-speed networks.
5. **Networking and Telecommunications Platforms:** It includes Windows server operating systems, Novell, Linux, and UNIX. Nearly all LANs and many wide area networks (WANs) use the TCP/IP standards for networking.
6. **Internet Platforms**: It overlaps with, and must relate to, the firm's general networking infrastructure and hardware and software platforms. Internet-related infrastructure includes the hardware, software and services to maintain corporate Web sites, intranets, and extranets, including Web hosting services and Web software application development tools. A Web hosting service maintains a large Web server, or series of servers, and provides fee-paying subscribers with space to maintain their Web sites.
7. **Consulting and System Integration Services**: Theses are relied on for integrating a firm's legacy systems with new technology and infrastructure and providing expertise in implementing new infrastructure along with relevant changes in business processes, training, and software integration. Legacy systems are generally older transaction processing systems created for mainframe computers that continue to be used to avoid the high cost of replacing or redesigning them.



Hardware Platforms and Emerging Technologies

If some of these IT infrastructure components like storage and telecommunications have gotten so cheap, why does it seem like companies are spending more and more money on information technology? This is because users are demanding better, faster, and easier ways to use computers and more ways to communicate with others. Let's discuss some of these hardware technologies that are helping companies meet the growing technology demand of employees, customers, suppliers, and business partners.

The Emerging Mobile Digital Platform

Anytime, anywhere, 24/7, 365. That's what computer users now expect. Technology manufacturers are meeting the demand with a host of new communication devices like cell phones and smartphones. The newest gadgets

on the market are **tablets** and e-book readers like the Kindle from Amazon.com or Barnes & Noble's Nook reader. Smartphones are getting —well—smarter, and proving more reasons for users to migrate away from traditional desktop PC computing.. Tablets are miniaturized subnotebooks that are built specifically for wireless communications and Internet access. Even though they may be small in size, they still pack a lot of computing power.

Grid Computing

Take a moment and think about how much time you *don't* use your personal computer. It's actually quite a lot. In fact, most computers are idle more time than not. What if you could combine all the idle time of hundreds or thousands of computers into a continuous, connected computing capacity to capture, process, manage, store, and retrieve data? You wouldn't have to purchase mammoth, super computers to realize this capability and capacity.

Grid computing is the technique that utilizes the idle computational resources of separate, geographically remote computers to create a single virtual supercomputer. In this process, a server computer breaks data and applications into discrete chunks that are parceled out to the grid's machines. Three reasons why grid computing is appealing to companies include:

→ Cost savings
→ Computational speed
→ Computational agility

Virtualization and Multicore Processors

Virtualization is the process of presenting a set of computing resources (such as computing power or data storage) so that they can all be accessed in ways that are not restricted by physical configuration or geographic location. Server virtualization enables companies to run more than one operating system at the same time on a single machine. Most servers run at just 10 to 15 percent of capacity, and virtualization can boost utilization server utilization rates to 70 percent or higher. Here's a list of the benefits businesses enjoy from using virtualization:

- Increase equipment utilization rates
- Conserve data center space and energy usage
- Require fewer computers and servers
- Combine legacy applications with newer applications
- Facilitate centralization and consolidation of hardware administration

A Multicore processor is an integrated circuit that contains two or more processors. This technology enables two or more processing engines with reduced power requirements and heat dissipation to perform tasks faster than a resource-hungry chip with a single processing core.

Cloud Computing and the Computing Utility

Cloud computing is already defined in this chapter. Basically, c**loud computing** is defined by five characteristics:

- → **On-demand self-service:** Users can access computing capabilities whenever and wherever they are.
- → **Ubiquitous network access:** No special devices are necessary for accessing data or services.
- → **Location independent resource pooling:** Users don't need to be concerned about where the data are stored.
- → **Rapid elasticity:** Computing resources expand and contract as necessary to serve users.
- → **Measured service:** Users pay only for the computing capabilities actually used.

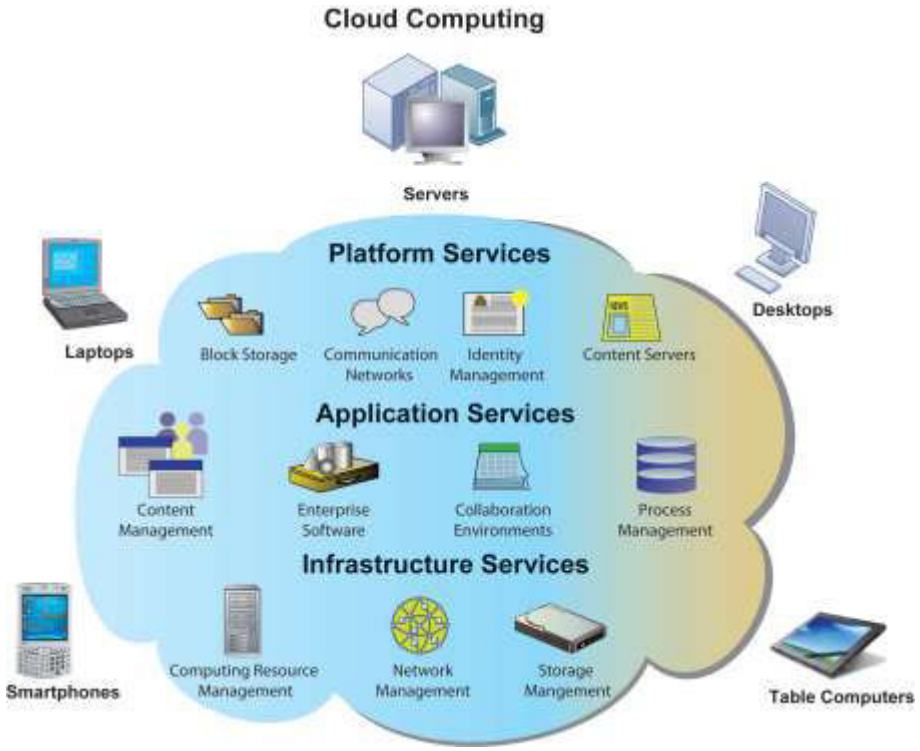


Figure 5-10 Cloud Computing Platform

Almost any type of computing device can access data and applications from these clouds through three types of services:

→ **Cloud infrastructure as a service:** Allows customers to process and store data, and use networking and other resources available from the cloud.

→ **Cloud platform as a service:** The service provider offers infrastructure and programming tools to customers so they can develop and test applications.

→ **Cloud software as a service:** The vendor provides software programs on a subscription fee basis.

Cloud computing is becoming popular because customers only pay for the computing infrastructure that they actually use. In many cases users experience lower IT costs than if they had to buy all the equipment, hire the technical staff to run it and maintain it, and purchase software applications. This type of **on-demand computing** is beneficial to small and medium-size companies since they can easily scale up and down their IT requirements as the pace of their business demands it. Larger organizations however, may not want their most sensitive data stored on servers which they don't control. System reliability is also a special concern to all businesses. The unavailability of business data and applications for even a few hours may be unacceptable. Three kinds of clouds are available:

→ **Public cloud**: A public cloud is basically the internet. Service providers use the internet to make resources, such as applications and storage, available to the general public. Examples of public clouds include Amazon Elastic Compute Cloud (EC2), IBM's Blue Cloud, Sun Cloud, Google AppEngine and Windows Azure Services Platform.

→ **Private cloud**: These clouds are data center architectures owned by a single company that provides flexibility, scalability, provisioning, automation and monitoring. The goal of a private cloud is not sell "as-a-service" offerings to external customers but instead to gain the benefits of cloud architecture without giving up the control of maintaining your own data center.

→ **Hybrid cloud**: By using a Hybrid clud, companies can maintain control of an internally managed private cloud while relying on the public cloud as needed. For instance during peak periods individual applications, or portions of applications can be migrated to the Public Cloud.

Autonomic Computing

Autonomic computing is a step toward creating an IT infrastructure that is able to diagnose and fix problems with very little human intervention. It is an industry-wide effort to develop systems that can configure, optimize, repair, and protect themselves against intruders and viruses, in an effort to free system administrators from routine system management, reduce costly system crashes. Today's virus software with automatic virus updates is one example of autonomic computing. Thus autonomic computing features systems that can:

→ Configure themselves
→ Optimize and tune themselves
→ Heal themselves when broken
→ Protect themselves from intruders and self-destruction

Although this type of computing is still rather new, it promises to relieve the burden many companies experience in trying to maintain massive, complex IT infrastructures.

Software Platform Trends and Emerging Technologies

You can have all the computer hardware money can buy, but if you don't have the right software, you can't do very much with the hardware and you've wasted a lot of money. There are five major themes in contemporary software platform evolution:

1. Linux and open-source software
2. Java
3. Enterprise software
4. Web services and service-oriented architecture
5. Software outsourcing

Linux and Open-Source Software

Open-Source software is software produced by a community of several hundred thousands of programmers around the world, and is available free of charge to be modified by users, with minimal restrictions. The premise that open-source software is superior to commercial software is based on the ability of thousands of programmers modifying and improving the software at a much faster rate. In return for their work, programmers receive prestige and access to a network of other programmers, and additional for-pay work opportunities. The process of

improving open source software is monitored by self-organized, professional programming communities. Thousands of open-source programs, ranging from operating systems to office suites, are available from hundreds of Web sites.

Linux is an operating system related to UNIX, is one of the most well-known open-source software, and is the world's fastest growing client and server operating system, along with related Linux applications. The rise of open-source software, particularly Linux and the applications it supports, has profound implications for corporate software platforms: cost reduction, reliability and resilience, and integration, because Linux works on all the major hardware platforms from mainframes to servers to clients. Because of its reliability, low cost, and integration features, Linux has the potential to break Microsoft's monopoly of the desktop.

Open-source software isn't limited to Linux but includes applications such as Mozilla Firefox Web browser and free office suite software such as OpenOffice. OpenOffice.org is the result of over twenty years' software engineering. Designed from the start as a single piece of software, it has a consistency other products cannot match.

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Software for the Web: Java, AJAX, and HTML

Java is an operating system-independent, object-oriented programming language, has become the leading programming environment for the Web, and its use has migrated into cellular phones, cars, music players, and more. For each of the computing environments in which Java is used, Sun has created a Java Virtual Machine that interprets Java programming code for that machine. In this manner, the code is written once and can be used on any machine for which there exists a Java Virtual Machine. A Macintosh PC, an IBM PC running Windows, a Sun server running UNIX, and even a smart cellular phone or personal digital assistant can share the same Java application.

AJAX stands for **A**synchronous **Ja**vaScript and **X**ML. AJAX is a new technique for creating better, faster, and more interactive web applications with the help of XML, HTML, CSS, and Java Script. Conventional web applications transmit information to and from the sever using synchronous requests. It means you fill out a form, hit submit, and get directed to a new page with new information from the server. With AJAX, when you hit submit, JavaScript will make a request to the server, interpret the results, and update the current screen. In the purest

sense, the user would never know that anything was even transmitted to the server. Simply we can say that AJAX is about updating parts of a web page, without reloading the whole page.

Hypertext markup language (HTML) is the language that used for creating web pages**.** The original version of HTML was created when the Web was first borne. It never took into account that eventually people would want to incorporate audio, video, and pictures within a Web page. More importantly, the authors of basic HTML language never envisioned that people would want to access the Web through small handheld devices, smartphones, tablets, and notebooks. As our computing hardware has evolved, so too must the software that provides information to all those devices. The next evolution of HTML is **HTML5**.

Web Services and Service-Oriented Architecture

Web services are XML-based information exchange systems that use the Internet for direct application-to-application interaction. These systems can include programs, objects, messages, or documents. Software applications written in various programming languages and running on various platforms can use web services to exchange data over computer networks like the Internet in a manner similar to inter-process communication on a single computer. This interoperability (e.g., between Java and Python, or Windows and Linux applications) is due to the use of open standards. Four software standards and communication protocols provide easy access to data and information via Web services:

→ **XML**—eXtensible Markup Language: Describes data in Web pages and databases.

→ **SOAP**—Simple Object Access Protocol: Allows applications to exchange data and instructions.

→ **WSDL**—Web Services Description Language: Describes a Web service so that other applications can use it.

→ **UDDI**—Universal Description, Discovery, and Integration: Lists Web services in a directory so users can find them.

A **service-oriented architecture** (**SOA**) is architecture in computer software design in which application components provide services to other components via a communication protocol, typically over a network. The principles of service-orientation are independent of any vendor, product or technology.

Software Outsourcing and Cloud Services

Like businesses were going to outside vendors to meet their hardware needs, Organizations are now doing much the same for their software needs. Three external sources for software outsourcing are: Software packages from a commercial vendor, cloud-based software services and tools, and outsourcing custom application development

→ Software Packages and Enterprise Software: **A commercial software package is a prewritten set of software programs for certain functions, eliminating the need for a firm to write its own software program. Rather than design, write, test, and maintain legacy systems, many organizations choose to purchase software packages from other companies that specialize in certain programs. Enterprise software is large and complex software that includes content, collaboration, and communication software. These systems are so complex that few corporations have the expertise to develop these in house. Vendors such as SAP and PeopleSoft have developed powerful software packages that can support business processes such as customer relationship management, supply chain management, human resource management.**

→ Software Outsourcing: **Outsourcing is a mechanism in which a firm contracts custom software development or maintenance to outside firms, normally to the firms operating in low-wage areas of the world. With the growing sophistication and experience of offshore firms, more and more new-program development is outsourced. The Internet has made this option more viable than it ever was. Companies primarily outsource to reduce certain costs — such as peripheral or "non-core" business expenses, high taxes, high energy costs, excessive government regulation/mandates, production and/or labor costs. The incentive to outsource may be greater for U.S. companies due to unusually high corporate taxes and mandated benefits, like social security, Medicare, and safety protection**

→ Cloud-based Software Services and Tools: **Small and mid-size companies in need of sophisticated software can rent only what they need and can afford through online** software as a service (SaaS) **providers**. **For instance, Right Now Technologies provides applications services via the Internet for customer service and marketing programs. Because these**

services are Web-based, data are accessible from virtually any computer connected to the Internet. Workers can collaborate with others in distant offices through a Web-based SaaS, and no one has to worry about their files being compatible with others. There is some danger to outsourcing your information resources to this kind of service. Remember, all your data are stored on another company's server computers and you have little control of it. What happens if the service provider goes out of business? How secure are data stored on the servers? These are just some of the issues managers must address when they consider using SaaS providers versus in-house technology support. Businesses must exercise caution when using software outsourcing or SaaS providers. Service level agreements (SLA) **help protect both customers and the service providers.**

Mashups and Apps

The term mash-up refers to a new breed of Web-based applications created by programmers to mix at least two different services from disparate, and even competing, Web sites. The term mash-up comes from the hip-hop music practice of mixing two or more songs. Mash-ups are often created by using a development approach called Ajax . Here's a sampling of mash-up Web sites:

- → Panoramio : a mash-up of Google Maps and geopositioned photographs of locations
- → Hiking Outpost : a mash-up of Amazon and online hiking information resources
- → HousingMaps : a mash-up of Google Maps and Craigslist rental ads that displays geographical information for rental properties.

App is an abbreviated form of the word application, and are very small programs that perform one particular task. They can be loaded to your hand-held computing device, including smartphones, e-book readers (in some cases) or tablet computers like the iPad. It's worth noting that most apps are developed for a specific device or devices from a specific company. Apps that are written for the Apple company will run on any Apple device. However, apps written for an Apple device will generally not run on a device manufactured or sold by Samsung or a BlackBerry. More and more apps are being created for the business user that lets her access server documents, call up sales data from the corporate database, or schedule meetings with colleagues or customers.

Chapter Unit 6

Foundations of Business Intelligence: Databases and Information Management

Data vs. Information

Data is raw facts collected from environment about physical phenomena or business transactions. Data can be in any form-numerical, textual, graphical, image, sound, video etc. It has no meaning. It is input to any system in an organization. For example, data would be the marks obtained by students in different subjects.

On the other hand information is defined as refined or processed data that has been transformed into meaningful and useful form for specific users. For example, after processing the marks obtained by student it transformed into information, which is meaningful and from which we can decide which student stood first, second and so forth. Information comes from data and takes the form of table, graphs, diagrams etc.

Data hierarchy \file organization concept

A computer system organizes data in a hierarchy that starts with bits and bytes and progresses to fields, records, files, and databases. A bit represents the smallest unit of data a computer can handle. A group of bits, called a byte, represents a single character, which can be a letter, a number, or another symbol. A grouping of characters into a word, a group of words, or a complete number (such as a person's name or age) is called a **field**. A group of related fields, such as the student's name, the course taken, the date, and the grade, comprises a **record**; a group of records of the same type is called a **file**.

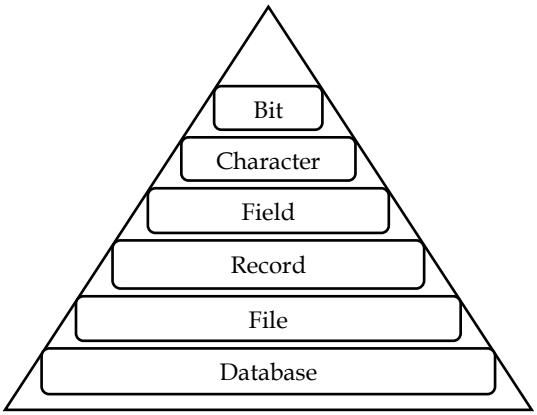
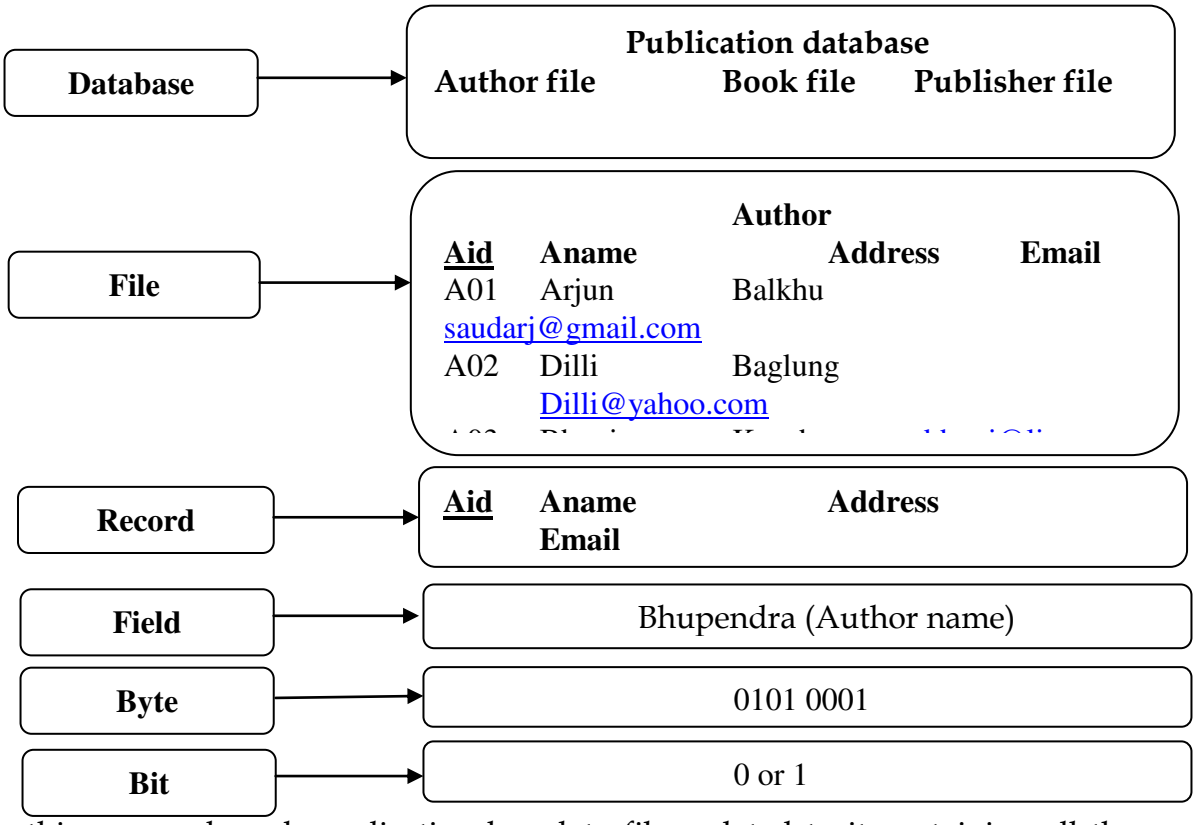


Figure: - Data Storage Hierarchy

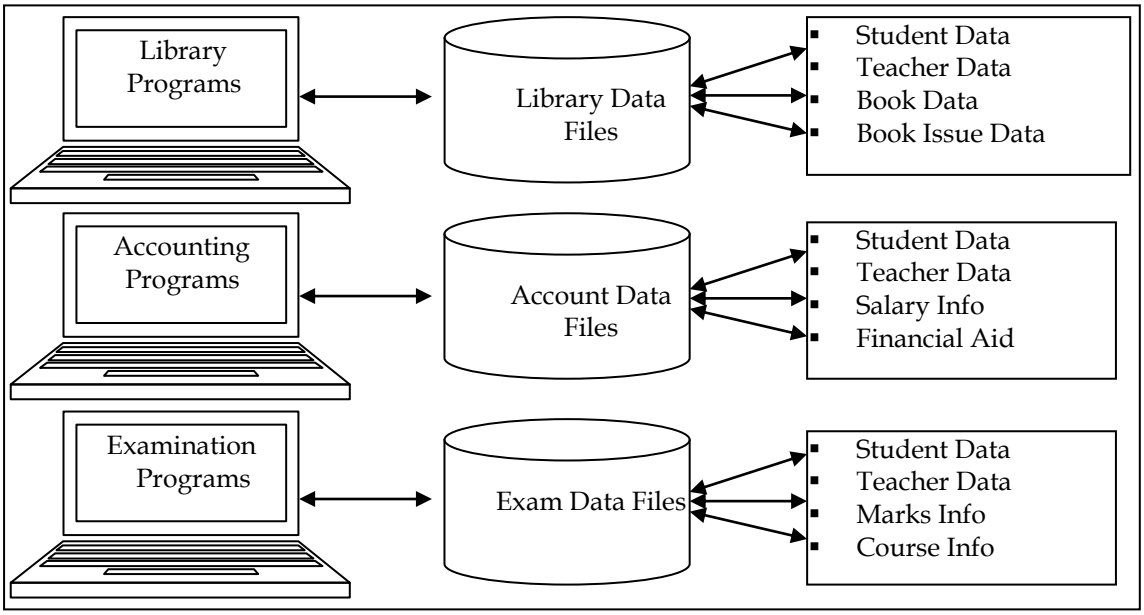
Organizing Data in a traditional file environment

File management systems (FMS) are also called flat file systems. It stores data in a plain text file. A flat file is a file that contains records, and in which each record is specified in a single line. Fields from each record may simply have a fixed width with padding, or may be delimited by whitespace, tabs, commas or other characters. Extra formatting may be needed to avoid delimiter collision. There are no structural relationships and the data are "flat" as in a sheet of paper. For example, the records in Figure below could constitute an author file. A group of related files makes up a **database (E.g. files author, book, and publisher etc makes up a database publication)**. The author file illustrated in Figure below could be grouped with files on book and publisher to create a publication database.



In this approach each application has data files related to it containing all the data records needed by the application. Thus, an organization has to develop number of application programs each with an associated application-specific data files. For example, in a college MIS, the library programs, accounting

programs, and examination programs would have their own data files as shown in figure below:



Problems with the traditional file environment

The key problems in the traditional file environment are listed below:

- Data Redundancy
- Data Inconsistency
- Data Isolation
- Difficulties in accessing data
- Integrity problem
- Atomicity problem
- Concurrent access anomalies
- Security problems

Data redundancy: Data redundancy means duplication of same data or data files in different places. Flat file systems are suffered from the problem of high data redundancy. For example, record (such as student id, name, level, program, section etc) of a student may appear in library data files as well as examination data files. This redundancy leads to higher storage and access cost. On the other hand database management systems can greatly reduce the problem of data redundancy. Note that DBMS cannot remove data redundancy problem completely.

Data inconsistency: Data inconsistency is side effect of data redundancy. Data is said to be inconsistent if various copies of the same data may no longer agree. Data inconstancy occurs if changed data is reflected in data files in one place but not elsewhere in the system. For example, if library data file contains cell number of a student as 9841567843 but examination data files stores 9851167895 as cell number of the student then we can say that data is inconsistent. Flat file systems may suffer from the problem of data inconsistency. But database systems can remove the problem of data inconstancy by automatically propagating data updates done in one file in the database in other data files.

Data isolation: Because data are scattered in various files, and files may be in different formats, writing new application programs to retrieve the appropriate data is difficult in flat file systems. For example, one data file may contain data separated of comma and another data file may contain data separated by white space.

Student Data file
S01, Suman, BBA,Mahendranagar
S02, Binu, B.Sc. CSIT, Kathmandu
S03, Ronit, B.E. Computer, Chitwan

(a)

Book Data file
B05 DBMS SaudArjun Kanchanpur
B06 java. SharmaDilli Baglung
B07 MIS BhattaJagadish Kanchanpur

(b)

Figure: *Data files (a) Data separated by comma (b) Data separated by white space*

Database management systems provide shared access to centrally stored data therefore it is easy for application programs to retrieve required data from centralized database. Application programs do not need to bother about format of stored data.

Difficulty in accessing data: File processing systems do not allow required data to be retrieved in efficient and convenient way**.** For example, assume we already have program to generate the list of books on the basis of subject. Now, if we need to generate the list of books on the basis of author name, either we need to extract the data from book data files manually or we should request the programmer to write a program to retrieve required data from the book data file. Both of the alternatives are not satisfactory.

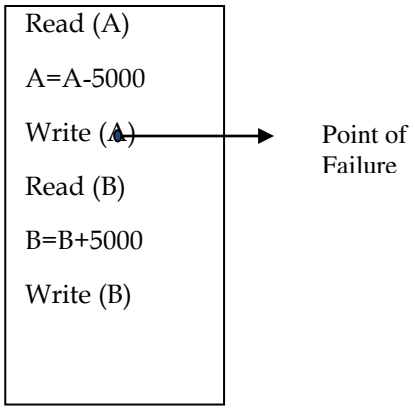
Integrity problems: Integrity means correctness of data before and after execution of a transaction. Integrity constraints are condition applied to the data. For example, if maximum salary in an organization is 150,000 then we have the integrity constraint "salary ≤ 150,000". Integrity constraints are important to maintain correctness of data. It plays vital to prevent users from doing mistakes. For example, if user mistakenly types 200,000 in place of 20,000 while transferring salary of an employee in his/her account, specified integrity constrain is violated and hence the system tell the user about the mistake.

Unfortunately, flat file systems do not allow us to specify integrity constraint and hence it is difficult to maintain correctness of data. On the other hand, database management systems allow us to specify integrity constraints on data therefore relatively it is easy to maintain correctness of data

.

Atomicity problems: Execution of transactions must be atomic. This means transactions must execute at its entirety or not at all. If execution of transaction is not atomic, it leaves database in incorrect sate. Consider the example of transaction that transfers 5000 rupees from account A to account B.

If the execution of transaction is failed at the point specified in above figure, it causes 5000 rupees to be deducted from account A without depositing it in account B. File processing system do not guarantee atomic execution of transactions and hence this type of problems may occur in databases. But database systems guarantees atomicity of execution of transaction and hence above mentioned problem can be eliminated.



Concurrent-access anomalies: Concurrent updates to same data by different transactions at the same time may result in inconsistent data. Consider bank account 'A', containing 50,000 Rs. If two customers withdraw funds say 15,000

and 20,000 respectively from account A at about the same time, the result of the concurrent executions may leave the account in an incorrect (or inconsistent) state, if the programs executing on behalf of each withdrawal read the old balance as below. Flat file systems do not supports execution of concurrent transactions and hence may suffer from the problem mentioned below. But, database systems support concurrent execution of transactions on the same data without resulting into inconstant data.

Withdraw by Customer1 (T1)	Withdraw by Customer2 (T2)	
Read (A)		
A=A-15000		
	Read (A) →	Reads old balance
	A=A-20000	Final Balance=30000
Write (A)		Wrong!!!!!!!!
	Write (A) →	It must be 15000

Security problems: In database system we may create different user accounts and provide different authorization to different users. Thus we are able to hide certain information from some users. For example, in a banking system, payroll personnel need to see only that part of the database that has information about the various bank employees. They do not need access to information about customer accounts. This type of restriction is essential for security purpose. But, file processing system do not allow us to create user accounts thus all users have equal access to the data. Due to this it is difficult to maintain security of flat file systems. Besides this file processing systems do not have any provisions for periodic backup of data and recovery from data loss which are provided by database management systems.

The database approach to data management

Database technology cuts through many of the problems of traditional file organization. A more rigorous definition of a **database** is a collection of data organized to serve many applications efficiently by centralizing the data and

controlling redundant data. Rather than storing data in separate files for each application, data are stored so as to appear to users as being stored in only one location.

Database Management Systems (DBMS)

A database is an organized collection of logically related data that contains information relevant to an enterprise. The database is also called the repository or container for a collection of data files. For example, **university database** maintains information about students, courses and grades in university.

A **Database Management System (DBMS)** is the set of programs that is used to store, retrieve and manipulate the data in convenient and efficient way. Main goal of database management system (DBMS) is to hide underlying complexities of data management from users and provide easy interface to them. Some common examples of the DBMS software are Oracle, Sybase, Microsoft SQL Server, DB2, MySQL, Postgres, Dbase, Ms-Access etc. Database management system that maintains relationship between multiple data files is called **Relational Database Management system** (**RDBMS**).

Program-ID	***Program-Name***
C002	BBA
C021	B. Sc CSIT
C112	BIM
C321	B. ed.

Student

S-ID	***Name***	***Address***	***Program-ID***
S-12	Pawan	Joshi	C002
S-14	Yamman	Karki	C021
S-51	Abin	Saud	C321
S-11	Binak	Singh	C112

Foreign Keys

Relationships

Primary Keys

Fi

g: F **oreign key**

A **database system** consists of database, d ***Program*** ıgement system, and application programs.

Simply, we can say th tware that uses DBMS for data management is called database system. Thus MS word is just an application program but it is not databas e it does not use DBMS for the purpose of managing data. On the other hand a library management information system can be database system if it uses DBMS for the purpose managing database. As mentioned above database is a repository for a collection of computerized data files. Users of database system can perform a variety of operation on such file. For example, in a database management system, the library system, accounting management system, and examination system

programs would have a common database. This database based approach to data processing is shown in fig below:

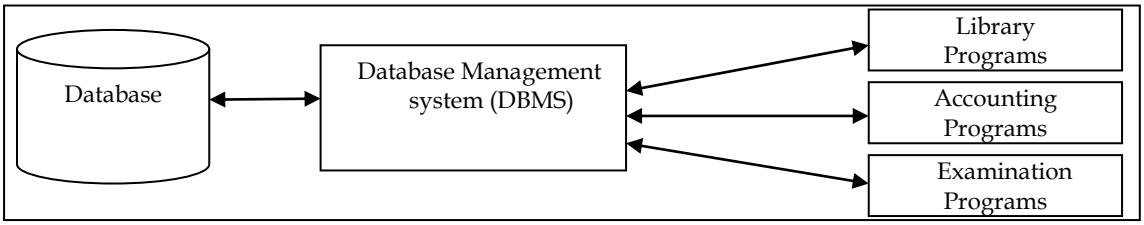


Figure: Database system approach to data processing

Capabilities of database Management systems

A DBMS includes capabilities and tools for organizing, managing, and accessing the data in the database. The most important are its data definition language, data dictionary, and data manipulation language.

DBMS have a **data definition** capability to specify the structure of the content of the database. It would be used to create database tables and to define the characteristics of the fields in each table. This information about the database would be documented in a data dictionary. A **data dictionary** is an automated or manual file that stores definitions of data elements and their characteristics.

The key capabilities of database management systems are listed below:

- Querying and reporting
- Maintaining complex relationship among data
- Provide backup and recovery
- Data availability
- Maintaining data integrity
- Minimize data redundancy
- Improve data security
- Handling concurrent access anomalies

Querying and reporting

The database contains the huge amount of data. Querying helps to filter the data and present only what the user requires. The most popular type of query language is SQL. It uses English like structured syntax for creating queries.

Now after filtering data from the database through query languages it is equally necessary to present the data in an appropriate structure. DBMS have the

capabilities to generate reports on the user-desired data based on user-desired structure. Crystal report is a popular report generator for large corporate DBMS.

Maintaining complex relationship among data

A database is the collection of interrelated data. The DBMS has the capabilities of creating a link between the data in various tables. This capability helps to retrieve complete information in a timely fashion as well as efficient update of data. In DBMS this type of relation can be created by using the concept of primary key and foreign key i.e. using referential integrity constraint concept.

Provide backup and recovery

DBMS has the capability to create a backup of the data. This backup can be used to recover the lost data when accidental loss of data occurs.

Data availability

One of the principle advantages is that the same business data can be made available to different employees anytime anywhere. DBMS enables multi-user access to information that is available remotely and 24 hours a day, 7 days a week.

Maintaining data integrity

Data accuracy, consistency and relevant data is a sign of data integrity. With the help of DBMS, companies can foster the integrity of their business records because changes to the data only have to be made in one place.

Minimize data redundancy

DBMS has the capabilities to keep the relationship among different tables due to which there is less chances of data redundancy. Information in DBMS is kept concise and appears just once. This capability reduces data redundancy.

Improve data security

DBMS allows user authentication through password. Authorized users can access only the data for which they are granted privilege. Thus it provides a system of permissions to restrict user access to certain data resources.

Handling concurrent access anomalies

Database management system prevents from accessing the data concurrently. It is achieved through isolation, which guarantees that other operations cannot access data that are being processed or modified during the transaction until it is completed.

How a DBMS Solves the Problems of the Traditional File Environment?

A DBMS reduces data redundancy and inconsistency by minimizing isolated files in which the same data are repeated. The DBMS may not enable the organization to eliminate data redundancy entirely, but it can help control redundancy. Even if the organization maintains some redundant data, using a DBMS eliminates data inconsistency because the DBMS can help the organization ensure that every occurrence of redundant data has the same values. The DBMS uncouples programs and data, enabling data to stand on their own. Access and availability of information will be increased and program development and maintenance costs reduced because users and programmers can perform ad hoc queries of data in the database. The DBMS enables the organization to centrally manage data, their use, and security.

Designing Database

To create a database, you must understand the relationships among the data, the type of data that will be maintained in the database, how the data will be used, and how the organization will need to change to manage data from a company-wide perspective. Designing a database requires an understanding of the business functions you want to model. It also requires an understanding of the database concepts and features that you want to use to represent those business functions. Make sure that you accurately design the database to model the business, because it can be time-consuming to significantly change the design of

a database after you implement it. A well-designed database also performs better.

The database requires both a conceptual design and a physical design. The conceptual, or logical, design of a database is an abstract model of the database from a business perspective, whereas the physical design shows how the database is actually arranged on direct-access storage devices.

The conceptual database design describes how the data elements in the database are to be grouped. The design process identifies relationships among data elements and the most efficient way of grouping data elements together to meet business information requirements. The process also identifies redundant data elements and the groupings of data elements required for specific application programs. Groups of data are organized, refined, and streamlined until an overall logical view of the relationships among all the data in the database emerges.

The conceptual database design deals with two important concepts:

- ☞ Normalization and
- ☞ Entity relationship diagram

1) Normalization

"The process of decomposing unsatisfactory "bad" relations by breaking up their attributes into smaller relations is called normalization"

While designing a database out of an entity–relationship model, the main problem existing in that raw database is redundancy. Redundancy is storing the same data item in more one place. A redundancy creates several problems like the following:

- Extra storage space: storing the same data in many places takes large amount of disk pace.
- Entering same data more than once during data insertion.
- Deleting data from more than one place during deletion.
- Modifying data in more than one place.
- Anomalies may occur in the database if insertion, deletion, modification etc are no done properly. It creates inconsistency and unreliability in the database.

To solve this problem, the raw database needs to be normalized. This is a step by step process of removing different kinds of redundancy and anomaly at each

step. At each step a specific rule is followed to remove specific kind of impurity in order to give the database a slim and clean look. The process of reducing data redundancy and removing database modification anomaly in a relational database is called normalization.

In brief the process of creating small, stable, yet flexible and adaptive data structures from complex groups of data is called **normalization**.

Example: Let's take a relation that is in un-normalized form as,

Student

Sid	Sname	Address	Phone_No
1	Bishnu	Kalanki	9849145464, 9813335467
2	Ramhari	Balkhu	9841882345, 099392844
3	Geeta	Kirtipur	9848334898,
4	Dipika	Pokhara	9849283847
5	Monika	Ratopool	9840084732, 9803267499

Since in this relation multi-valued attribute exist thus this relation is not in normalized form. Now converting this relation into normal form by decomposing this relation into two relations as,

Student

Sid	Sname	Address
1	Bishnu	Kalanki
2	Ramhari	Balkhu
3	Geeta	Kirtipur
4	Dipika	Pokhara
5	Monika	Ratopoo l

Phone

Sid	Phone_No
1	9849145464
1	9813335467
2	9841882345
2	099392844
3	9848334898
4	9849283847
5	9840084732
5	9803267499

Fig: Relations in Normalized form

Example 2: **Employee-Department**

Emp-Id	Emp-Name	Emp-Salary	Dept-No	Dept-Name
1	Bhupi	40000	D1	BBA
1	Bhupi	40000	D2	CSIT
2	Bindu	30000	D3	BBS

3	Arjun	60000	D1	CSIT

In the above relation {Emp-Id, Dept-No} is the primary key. Emp-Name, Emp-Salary and Dept-Name all depend upon {Emp-Id, Dept-No}. Again Emp-Id→Emp-Name, Emp-Id→Emp-Salary and Dept-No→Dept-Name, thus there also occur partial dependency. Due to which this relation is not in 2 NF.

Now converting this relation into 2 NF by decomposing this relation into three relations as,

Employee

E_Id	***E_Name***	***E_Salary***
1	Bhupi	40000
2	Bindu	30000
3	Arjun	60000

Emp-Dept

E_Id	***D_No***
1	*D1*
1	*D2*
2	*D3*
3	*D1*

Department

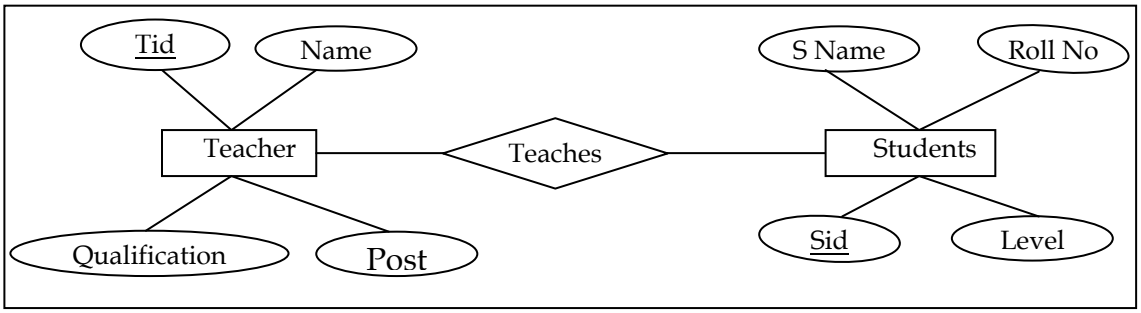
D_No	***D_Name***
D1	BBA
D2	CSIT
D3	BBS

Fig: Relations in 2 NF

2) Entity relationship diagram

An **E-R diagram** is a specialized graphical tool that demonstrates the interrelationships among various entities of a database. It is used to represent the overall logical structure of the database. While designing E-R diagrams, the emphasis is on the schema of the database and not on the instances. This is because the schema of the database is changed rarely; however, the instances in the entity and relationship sets change frequently. Thus, E-R diagrams are more useful in designing the database. E-R diagram focuses high level database design and hides low level details of database representation therefore it can be used to communicate with users of the system while collecting information.

Example:



Using databases to improve business performance and decision making

In a large company, with large databases or large systems for separate functions, such as manufacturing, sales, and accounting, special capabilities and tools are required for analyzing vast quantities of data and for accessing data from multiple systems. These capabilities include data warehousing, data mining, and tools for accessing internal databases through the Web.

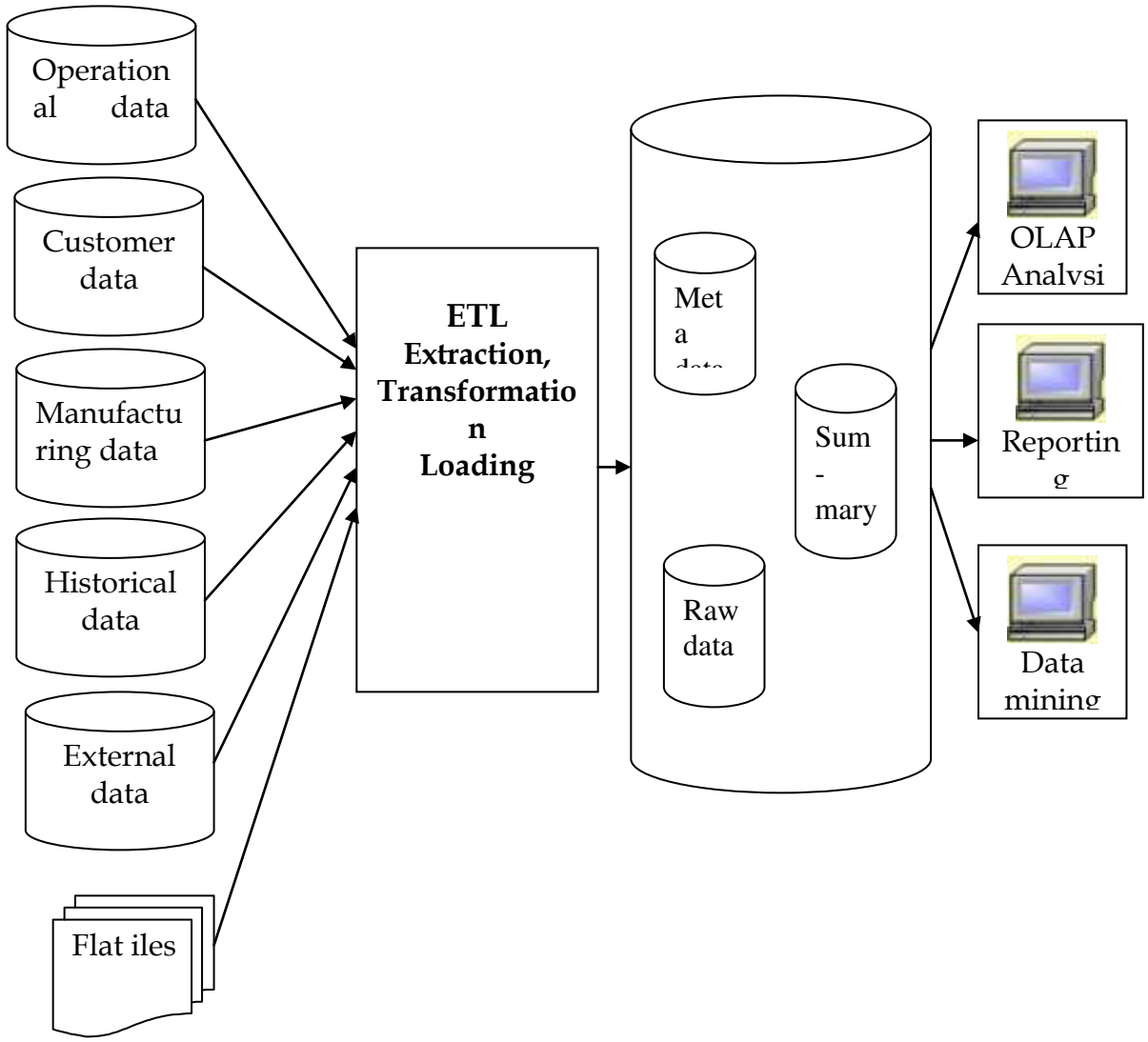
Data Warehouse

A data warehouse is a repository of multiple heterogeneous data sources organized under a unified schema at a single site to facilitate management decision making. A data warehouse is a subject-oriented, integrated, time-variant and nonvolatile collection of data in support of management's decision-making process.

a. **Subject-Oriented**: A data warehouse can be used to analyze a particular subject area. For example, "sales" can be a particular subject.
b. **Integrated**: A data warehouse integrates data from multiple data sources. For example, source A and source B may have different ways of identifying a product, but in a data warehouse, there will be only a single way of identifying a product.
c. **Time-Variant**: Historical data is kept in a data warehouse. For example, one can retrieve data from 3 months, 6 months, 12 months, or even older data from a data warehouse. This contrasts with a transactions system, where often only the most recent data is kept. For example, a transaction system may hold the most recent address of a customer, where a data warehouse can hold all addresses associated with a customer.
d. **Non-volatile**: Once data is in the data warehouse, it will not change. So, historical data in a data warehouse should never be altered.

A **data warehouse** is a repository of current and historical data of an organization that are organized to facilitate reporting and analysis. The data originate in many core operational transaction systems, such as systems for sales, customer accounts, and manufacturing, and may include data from Web site transactions. The data warehouse consolidates and standardizes information from different operational databases so that the information can be used across

the enterprise for management analysis and decision making. Figure below illustrates how a data warehouse works. The data warehouse makes the data available for anyone to access as needed, but it cannot be altered. A data warehouse system also provides a range of ad hoc and standardized query tools, analytical tools, and graphical reporting facilities. Many firms use intranet portals to make the data warehouse information widely available throughout the firm.



Data warehouse

How does a data warehouse differ from a database?

There are a number of fundamental differences which separate a data warehouse from a database. The biggest difference between them is that most database place an emphasis on a single application, and this application will generally be one that is based on transaction. If the data is analyzed, it will be done within a single domain. In contrast, data warehouses deal with multiple domains simultaneously.

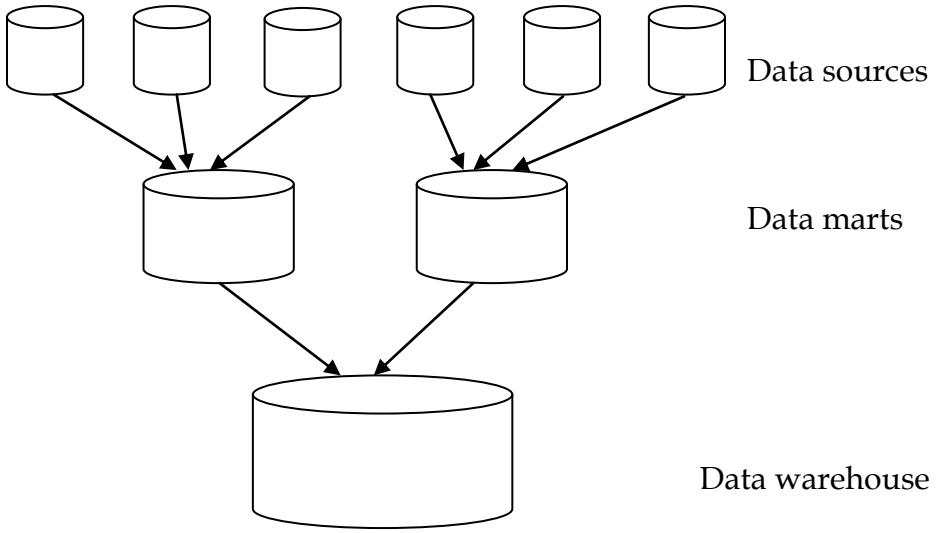
Because data warehouse deals with multiple subject areas, the data warehouse finds connections between them. This allows the data warehouse to show how the company is performing as a whole, rather than in individual areas.

Another powerful aspect of data warehouse is their ability to support the analysis of trends. They are not volatile, and the information stored in them doesn't change as much as it would in a common database. Some of the major differences between them are listed below:

Database	Data Warehouse
1. In database tables and joins of different tables are complex since they are normalized for RDBMS. This is done to reduce redundant data and to save storage space. 2. Entity Relational modeling techniques are used for RDBMS database design. 3. Performance is low for analysis queries. 4. Database is the place where the data is taken as a base and managed to get available fast and efficient access. 5. Optimized for write operation. 6. Used for Online Transaction Processing (OLTP) but can be used for other purpose such as data warehousing. This records the data from the user for history.	1. In data warehouse tables and joins are simple since they are de-normalized. This is done to reduce the response time for analytical queries. 2. Data modeling techniques are used for Data Warehouse design. 3. High performance for analytical queries 4. Data warehouse is the place where the application data is managed for analysis and reporting purpose. 5. Optimized for read operations. 6. Used for Online Analytical Processing (OLAP). This reads the historical data for the users for business decision.

Data Marts

Data mart is a database that contains a subset of data present in a data warehouse. We can divide a data warehouse into data marts after the data warehouse has been created. A **data mart** is a subset of a data warehouse in which a summarized or highly focused portion of the organization's data is placed in a separate database for a specific population of users. For example, a company might develop marketing and sales data marts to deal with customer information. A data mart typically focuses on a single subject area or line of business, so it usually can be constructed more rapidly and at lower cost than an enterprise-wide data warehouse.



Reasons for creating a data mart

- Creates collective view by a group of users
- Easy access to frequently needed data
- Ease of creation
- Improves end-user response time
- Lower cost than implementing a full data warehouse
- Potential users are more clearly defined than in a full data warehouse
- Contains only business essential data and is less cluttered

Tools for business Intelligence

Once data have been captured and organized in data warehouses and data marts, they are available for further analysis using tools for business intelligence. Business intelligence tools enable users to analyze data to see new patterns, relationships, and insights that are useful for guiding decision making. Principal tools for business intelligence include software for database querying and reporting, tools for multidimensional data analysis (online analytical processing), and tools for data mining.

Online analytical processing (OLAP): Multidimensional data analysis

OLAP supports multidimensional data analysis, enabling users to view the same data in different ways using multiple dimensions (data cube). Multidimensional data models are designed expressly to support data analyses. The goal of multidimensional data models is to support analysis in a simple and faster way by executives, managers and business professionals. These people are not interested in the overall architecture.

Suppose your company sells five different products—Laptops, Computers, TVs, Camera and Mobiles—in the East, West, North and Central regions. If you wanted to ask a fairly straightforward question, such as how many Computers were sold in the last week, you could easily find the answer by using sales database. But what if you wanted to know how many Computers sold in each of your sales regions and compare actual results with projected sales, then the querying becomes complicated. In such a case OLAP is used.

Each aspect of information—product, pricing, cost, region, or time period—represents a different dimension. So, a product manager could use a multidimensional data analysis tool to learn how many Computers were sold in the East reason in this week, how that compares with the previous week, and how it compares with the sales forecast. OLAP enables users to obtain online answers to ad hoc questions such as these in a fairly rapid amount of time, even when the data are stored in very large databases, such as sales figures for multiple years.

Time	Product	Location	Sales
2072-01-01	Computer	East region	30
2072-01-01	Laptop	West region	20
2072-01-01	Camera	Central region	50
2072-01-07	Mobile	East region	11

2072-01-07	TV	North region	23
2072-01-15	Computer	West region	54
2072-01-15	Laptop	Central region	09
2072-01-25	Laptop	East region	32
2072-01-25	TV	West region	19

Fig: Tabular representation

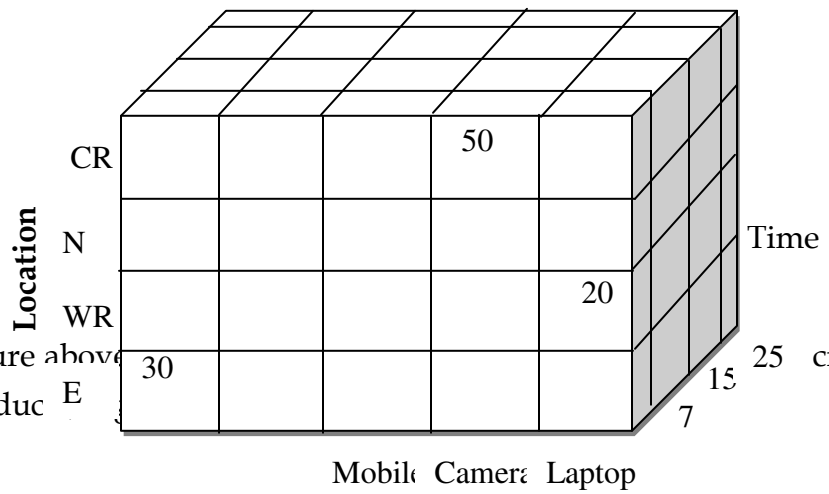


Figure above created to represent produc

Data mining

Data mining refers to extracting or "mining" knowledge, interesting information or patterns from large amount of data. Data mining is a process of discovering interesting knowledge from large amounts of data stored either, in database, data warehouse, or other information repositories.

It is the semi-automatic process of extracting and identifying patterns from stored data. A data mining application, or data mining tool, is typically a software interface which interacts with a large database containing customer or other important data. Data mining is widely used by companies and public bodies for such uses as marketing, detection of fraudulent activity etc. That is, data mining deals with "knowledge discovery in databases. There are a wide variety of data mining applications available, particularly for business uses, such as Customer Relationship Management (CRM). These applications enable marketing managers to understand the behaviors of their customers and also to predict the potential behavior of prospective clients.

Data mining is a logical process that is used to search through large amount of data in order to find useful data. The goal of this technique is to find patterns that were previously unknown. Once these patterns are found they can further be used to make certain decisions for development of their business.

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Functions of data mining

The types of information obtainable from data mining include associations, sequences, classifications, clusters, and forecasts.

- **Association:** Association is one of the best known data mining technique. In association, a pattern is discovered based on a relationship between items in the same transaction. That is the reason why association technique is also known as relation technique. The association technique is used in market basket analysis to identify a set of products that customers frequently purchase together. For instance, books that tends to be bought together. If a customer buys a book, an online bookstore may suggest other associated books. If a person buys a camera, the system may suggest accessories that tend to be bought along with cameras.
- **Prediction:** The prediction, as it name implied, is one of a data mining techniques that discovers relationship between independent variables and relationship between dependent and independent variables. For instance, the prediction analysis technique can be used in sale to predict profit for the future if we consider sale is an independent variable, profit could be a dependent variable. For instance, when a person applies for a credit card, the credit-card company wants to predict if the person is a good credit risk. The prediction is to be based on known attributes of the person, such as age, income, debts, and past debt repayment history.
- **Classification:** Classification is a classic data mining technique based on machine learning. Basically classification is used to classify each item in a set of data into one of predefined set of classes or groups. Classification method makes use of mathematical techniques such as decision trees, linear programming, neural network and statistics. For example, we can apply classification in application that "given all records of employees who left the company; predict who will probably leave the company in a future period." In this case, we divide the records of employees into two groups that named "leave" and "stay". And then we can ask our data mining software to classify the employees into separate groups.
- **Clustering:** Clustering is a data mining technique that makes meaningful or useful cluster of objects which have similar characteristics using automatic technique. The clustering technique defines the classes and puts

objects in each class, while in the classification techniques, objects are assigned into predefined classes. For example in a library, there is a wide range of books in various topics available. The challenge is how to keep those books in a way that readers can take several books in a particular topic without hassle. By using clustering technique, we can keep books that have some kinds of similarities in one cluster or one shelf and label it with a meaningful name.

Text mining

Text mining is the discovery of patterns and relationships from large sets of unstructured data—the kind of data we generate in e-mails, phone conversations, blog postings, online customer surveys, and tweets.

Web mining

The discovery and analysis of useful patterns and information from the World Wide Web or simply web is called web mining. Web mining is the application of data mining technique to find interesting and potentially useful knowledge from web data. So web mining is the application of data mining technique to extract knowledge from web data, including web documents, hyperlinks between documents, usage logs of web sites etc.

Businesses might turn to Web mining to help them understand customer behavior, evaluate the effectiveness of a particular Web site, or quantify the success of a marketing campaign. For instance, marketers use Google Trends and Google Insights for Search services, which track the popularity of various words and phrases used in Google search queries, to learn what people are interested in and what they are interested in buying.

Chapter 7
Securing Information Systems

As our society and the world come to depend on computers and information systems more and more, firms must put better effort in making their systems less vulnerable and more reliable. The systems must also be more secure when processing transactions and maintaining data.

System Vulnerability and Abuse

As firms become more technologically oriented, they must become more aware of **security** and **control** issues surrounding their information systems and protect the resources.

Why Systems Are Vulnerable?

Vulnerability is weakness or flaw in a computer system that can be exploited by a threat. Security **threat** is a possible danger that might exploit **vulnerabilities** in a computer system to breach security and thus cause possible harm. Information systems are vulnerable to technical, organizational, and environmental threats from internal and external sources. If managers at all levels don't make security and reliability their number one priority, then the threats to an information system can easily become real. The figure below gives you an idea of some of the threats to each component of a typical network.

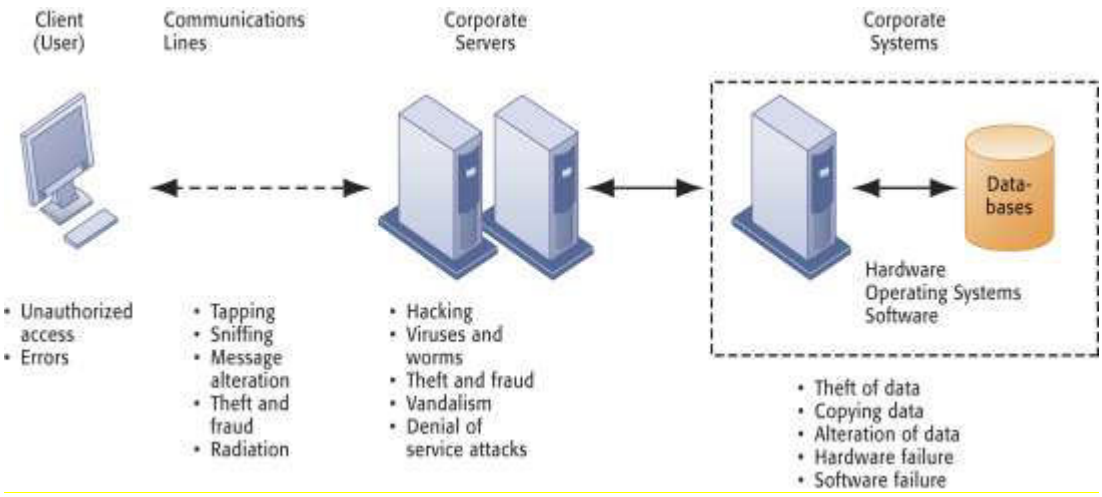

Figure: Contemporary Security Challenges and Vulnerabilities

Businesses that partner with outside companies are more vulnerable. Partnering companies may not protect information as strictly. Employees of the partnering firm may not view security as diligently as the primary business. In today's business environment, it's not enough to protect hardware and software physically located within an organization. Mobile computing devices like smartphones, cell phones, netbooks, and laptops, add to the vulnerability of information systems by creating new points of entry into information systems.

Internet Vulnerabilities

If you connect to the Internet with a cable modem or DSL you are much more vulnerable to hackers on your home PC than if you connect with a dial-up modem. That's because you are always connected, with a permanent IP address, which makes it easier for hackers to find you. The only smart thing to do is keep your software up-to-date and include firewall protection.

Because distributed computing is used extensively in network systems, you have more points of entry, which can make attacking the system easier. The more people you have using the system, the more potential for fraud and abuse of the information maintained in that system. That's why you have to make it everybody's business to protect the system.

Malicious Software

Malicious software, commonly known as malware, is any software that brings harm to a computer system. It can be used to disrupt computer operation, gather sensitive information, or gain access to private computer systems. Malware can be in the form of worms, viruses, Trojans etc., which steal protected data, delete documents or add software not approved by a user. Malware takes partial to full control of our computer to do whatever the malware creator wants. Most malware requires the user to initiate its operation. Some form of attacks includes attachments in e-mails, browsing a malicious website that installs software after the user clicks ok on a pop-up.

Worms

This type of **Malware** uses network resources for spreading. This class was called **worms** because of its peculiar feature to creep from computer to computer using network, mail and other informational channels. Worms intrude our computer, calculate network addresses of other computers and send to these addresses its copies. Many worms that have been created are designed only to spread, and do not attempt to change the systems they pass through. The biggest danger with a worm is its capability to replicate itself on your system, so it could send out hundreds or thousands of copies of itself, creating a huge devastating effect.

One example would be for a worm to send a copy of itself to everyone listed in your e-mail address book. Then, the worm replicates and sends itself out to everyone listed in each of the receiver's address book, and the manifest continues on down the line. Due to the copying nature of a worm and its capability to travel across networks the end result in most cases is that the worm consumes too much system memory (or network bandwidth), causing web servers, network servers and individual computers to stop responding.
Father Christmas is an example of worm. It was distributed in 1987 and was designed for IBM networks. It was an electronic letter instructing recipient to save it and run it as a program that drew Christmas tree, printed "Merry Christmas!" It also checked address book, list of previously received email and sent copies to each address. The worm quickly overwhelmed the IBM networks and forced the networks and systems to be shut down

Virus
A *computer virus* is a program that inserts itself into one or more files and then performs some (possibly null) action. Computer virus works in two phases. The first phase, in which the virus inserts itself into a file, is called the insertion phase. The second phase, in which it performs some action, is called the execution phase. Almost all viruses are attached to an executable, which means the virus may exist on our computer but it actually cannot infect your computer unless we run or open the malicious program. It is important to note that a virus cannot be spread without a human action, (such as running an infected program) to keep it going. Because a virus is spread by human action people will unknowingly continue the spread of a computer virus by sharing infecting files or sending emails with viruses as attachments in the email.

The *Brain (or Pakistani) virus*, written for IBM PCs is an example of this category. It is thought to have been created in early 1986 but was first reported in the United States in October 1987. It alters the boot sectors of floppy disks, possibly corrupting files in the process. It also spreads to any uninfected floppy disks inserted into the system.

Torjan Horse
Trojan horses are the files that claim to be something desirable but, in fact, are malicious code or logic. The Trojan Horse, at first glance will appear to be useful software but will actually do damage once installed or run on your computer. Receivers of a Trojan Horse are usually tricked into opening them because they appear to be receiving legitimate software or files from a legitimate source. When a Trojan is activated on your computer, the results can vary. Some Trojans are designed to be more annoying than malicious like changing our desktop, adding silly active desktop icons etc. Sometimes they can cause serious damage by deleting files and destroying information on your system.

Trojans are also known to create a backdoor on your computer that gives malicious users access to your system, possibly allowing confidential or personal information to be compromised. Unlike viruses and worms, Trojans do not reproduce by infecting other files nor do they self-replicate. A program named "waterfalls.scr" serves as a simple example of a Trojan Horse. The author claims it is a free waterfall screensaver. When run, it instead unloads hidden programs, commands, scripts, or any number of commands without the user's knowledge or consent.

Spyware

Spyware is any software installed on your PC that collects your information without your knowledge, and sends that information back to the creator so they can use your personal information in some nefarious way. This could include keylogging to learn your passwords, watching your searching habits, changing out your browser home and search pages, adding obnoxious browser toolbars, or just stealing your passwords and credit card numbers.

Since spyware is primarily meant to make money at your expense, it doesn't usually kill your PC—in fact, many people have spyware running without even realizing it, but generally those that have one spyware application installed also have a dozen more. Once you've got that many pieces of software spying on you, your PC is going to become slow.

Did you know? What is backdoor?

A backdoor in a computer system is a method of bypassing normal authentication, securing unauthorized remote access to a computer, obtaining access to plain text, and so on, while attempting to remain undetected.

Hackers and Computer Crime

A hacker is someone who seeks and exploits weaknesses in a computer system or computer network. Hackers may be motivated by a multitude of reasons, such as profit, protest, challenge, enjoyment, or to evaluate those weaknesses to assist in removing them. Hacking practice can either be ethical or unethical. The activity where one breaks into the system but do not violate its security and credentials is called *Ethical Hacking*. Ethical hackers aim to bring into the administrator's notice and vulnerabilities in the system thereby, improvising the robustness and security. Thus term *hacker* does not mean criminal or bad guy. Actually, hackers are the persons with flawless programming skills and hands-on knowledge on both computer hardware and software.

On the other hand, there are people who can though break into systems, get access to secured accounts but their actions are usually unauthorized while they make a backdoor entry into your system. These people (often misinterpreted as hackers) are called as *crackers*. They try and crack passwords, security codes, etc

using various hacking software's which are already available. Such software's are meant to break the code using millions of trials programmed into it by other hackers.

Spoofing and Sniffing

These are two methods that hackers and criminals use to gain improper or illegal access to computer systems. **Spoofing** is becoming a common way to steal financial information through fake Web sites. The spoofed site is almost a mirror image of the real site and unless the unsuspecting user examines the spoof closely, he/she may inadvertently give out important personal and financial information.

Using a **sniffer** program is a popular way to "grab" information as it passes over transmission lines regardless of whether they are hard-wired or wireless. It is almost impossible to detect and encryption is about the only way to safeguard against it.

Denial of Service Attacks

As companies and organizations expand their business to Web sites, they are opening another point of vulnerability through **denial of service attacks.** Using **botnets** to launch **distributed denial of service attacks** is becoming all too common. The hackers seem to enjoy attacking the most popular Web sites like Facebook and Twitter.

Denial of service attacks are at the core of some of the most serious forms of cyberwarfare being played out across the world between countries and governments. From Russia to Iran to South Korea, government networks are being targeted through these kinds of attacks. The use of botnets makes it very difficult to determine the origin of the attacks and pinpoint responsibility.

Computer Crime

Computer crime is a growing national and international threat to the continued development of e-business and e-commerce. When the Internet was first created in the late 1960s, the designers intentionally built it to be open and easily accessible. Little did they know 40 years later, that structure would be the very cause of so much crime and vandalism. Table below lists the best known examples of computer crime.

TABLE 8-2 EXAMPLES OF COMPUTER CRIME

COMPUTERS AS TARGETS OF CRIME
Breaching the confidentiality of protected computerized data
Accessing a computer system without authority
Knowingly accessing a protected computer to commit fraud
Intentionally accessing a protected computer and causing damage, negligently or deliberately
Knowingly transmitting a program, program code, or command that intentionally causes damage to a protected computer
Threatening to cause damage to a protected computer
COMPUTERS AS INSTRUMENTS OF CRIME
Theft of trade secrets
Unauthorized copying of software or copyrighted intellectual property, such as articles, books, music, and video
Schemes to defraud
Using e-mail for threats or harassment
Intentionally attempting to intercept electronic communication
Illegally accessing stored electronic communications, including e-mail and voice mail
Transmitting or possessing child pornography using a computer

It's very difficult for our society and our governments to keep up with the rapid changes in the types of computer crime being committed. Many laws have to be rewritten and many new laws must be implemented to accommodate the changes.

Identity Theft

The fastest growing crime off or on the Internet is **identity theft**. Even though identity theft is most likely to occur in an offline environment, once your personal information has been stolen it's easy to use it in an online environment.

There are many precautions people can take to help prevent identity theft. One way is to scrutinize emails or phone calls that ask for your personal information or financial account information. No legitimate financial institution will ever send an email requesting you to supply your account information. That is the number one indicator that the email is a **phishing** email. You should ignore and delete the email immediately.

Click Fraud

All those ads you see on Web sites cost the sponsor money. Every time someone clicks on an ad, the sponsor is charged a pay-per-click fee. The fee is

based on the popularity of the search words that generated the ad. What if your company is paying for an ad with little or no resultant traffic to your Web site? That's what happens in the case of click fraud. A person or a software program continually hits on the ad, driving up the advertising fees, without any intention of actually visiting the site.

Internal Threats: Employees

It is surprising to learn that most computer crime against companies is committed by current or former employees. They know the system best, are entrusted with huge amounts of data, and have the easiest access. Managers and executives need to be aware of potential internal threats to their systems and put special measures in place to safeguard systems and data. They also need to impress upon all employees how important security is throughout the system right down to the last person.

Password theft is the easiest way for hackers to gain access to a system. No, they don't come into your office at night and look at the piece of paper in your desk drawer that has your password written on it. They generally use specially written software programs that can build various passwords to see if any of them will work. That's why you should use odd combinations of letters and numbers not easily associated with your name to create your password. The longer the password, the harder it is to replicate. The same password should not be used for more than one access point. Using multiple passwords limits the damage done if a hacker does manage to obtain a single password.

Safeguarding individual passwords from **social engineering** maliciousness is the responsibility of everyone in the organization. An effective way of limiting access to data is to establish computer-generated logs that show every employee who logged on, what they did, what part of the system they accessed, and whether any data were used or updated. Logs are easily created by system software programs and should be periodically reviewed by the information technology staff and department managers. If nothing else, it gives them an idea of what their employees are doing.

Business Value of Security and Control

Transactions worth billions and trillions of dollars are carried out on networks every day. Think of the impact if the networks experience downtime for even a few minutes. It may create serious harm to business reputation of the organization.

If a business doesn't adequately protect its systems for any other reason, it should just to avoid expensive and time-consuming legal action. The national retailer T.J. Maxx was forced to spend about $200 million in court case and damage costs after it experienced a serious security breach in 2008.

Legal and Regulatory Requirements for Electronic Records Management

Because so much of our personal and financial information is now maintained electronically, the government needs to pass laws mandating how the data will be protected from unauthorized or illegal misuse. Govt. of Nepal has already passed a cyber law outlining the requirements for electronic records management and is in process of modifying the law and creating new laws.
All of these laws are in response to computer crimes and abuses that businesses or individuals have committed or experienced.

Electronic Evidence and Computer Forensics

Several things are happening in the corporate worlds that are changing the requirements for how companies handle their electronic documents:

- Companies are communicating more and more with email and other forms of electronic transmissions, and
- Courts are allowing all forms of communication to be held as evidence.

Therefore businesses must develop methods of capturing, storing, and presenting any and all electronic communications including email, instant messaging, and e-commerce transactions.

Computer forensics is the application of investigation and analysis techniques to gather and preserve evidence from a particular computing device in a way that is suitable for presentation in a court of law. It can be used in the detection and prevention of crime and in any dispute where evidence is stored digitally. **Computer forensics** is a growing field because of the increasing digitization of documents and communications. Many people believe that just because they delete a file from a computer file directory that it's no longer available or recoverable. That's a false belief. Data remains on hard drives in magnetic form long after it's apparently been deleted. People trained in computer forensics are able to uncover ambient data and other forms of electronic evidence that can be used in courts of law. Businesses and employees must increase their awareness of the necessity for keeping good records.

Establishing a Framework for Security and Control

To prevent security related problems one of the best ways is to institute controls into our information system through methods, policies, and procedures.

Information Systems Controls

These are just a few examples to get you to think about the fact that the company designs the security into the building from the beginning. It doesn't wait until everything is built. You should do the same thing with an information system. It's no different from any other system that requires planning and well-thought-out policies and procedures *before* construction begins.

The two types of information system controls are:

- **General controls:** Software, physical hardware, computer operations, data security, implementation process, and administrative. Table given below describes each of these.
- **Application controls**: Input, processing, and output.

TABLE 8.4 GENERAL CONTROLS

TYPE OF GENERAL CONTROL	DESCRIPTION
Software controls	Monitor the use of system software and prevent unauthorized access of software programs, system software, and computer programs.
Hardware controls	Ensure that computer hardware is physically secure, and check for equipment malfunction. Organizations that are critically dependent on their computers also must make provisions for backup or continued operation to maintain constant service.
Computer operations controls	Oversee the work of the computer department to ensure that programmed procedures are consistently and correctly applied to the storage and processing of data. They include controls over the setup of computer processing jobs and backup and recovery procedures for processing that ends abnormally.
Data security controls	Ensure that valuable business data files on either disk or tape are not subject to unauthorized access, change, or destruction while they are in use or in storage.
Implementation controls	Audit the systems development process at various points to ensure that the process is properly controlled and managed.
Administrative controls	Formalize standards, rules, procedures, and control disciplines to ensure that the organization's general and application controls are properly executed and enforced.

Risk Assessment

Companies and government systems constantly use **risk assessment** to determine weak links in their physical building security. You can use the same methodology to assess the risk in your information system. Use risk assessment to set up cost comparisons for developing and maintaining security against the loss potential. It's done all the time in other systems, so use it for your information system as well.

Security Policy

Because of the increasing liability for security breaches, many companies are now establishing a chief security officer position to help ensure the firm maximizes the protection of information resources. Some tools available to the CSO are:

- **Security policy:** Principle document that determines security goals and how they will be achieved.
- **Acceptable use policy:** Outlines acceptable and unacceptable uses of hardware and telecommunications equipment.
- **Identity management system:** Manages access to each part of the information system.

Identity management is one of the most important principles of a strong, viable security policy. It includes:

- Business processes and software tools for identifying valid system users.
- Controlling access to system resources.
- Policies for identifying and authorizing different categories of system users.
- Specifying what systems or portions of systems each user is allowed to access.
- Processes and technologies for authenticating users and protecting their identities

Disaster Recovery Planning and Business Continuity Planning

Floods, fires, hurricanes, even tsunamis, happen without a moment's notice. Perhaps the most important element of a successful system is a **disaster recovery plan.** Those firms that had completed **business continuity planning** were able to carry on business, while those that hadn't, spent days and weeks recovering from the terrorist attacks. It's important that managers and employees work with information system technicians to develop these plans.

The Role of Auditing

Companies audit their financial data using outside firms to make sure there aren't any discrepancies in their accounting processes. Perhaps they audit their supply systems on a periodic basis to make sure everything is on the up-and-up. They should also audit their information systems. After all, information is as an important resource as any other in the organization. **MIS audits** verify that the system was developed according to specifications, that the input, processing, and output systems are operating according to requirements, and that the data is

protected against theft, abuse, and misuse. In essence, an MIS audit checks all the controls we've discussed in this chapter.

Note:- This note was provided by Plos Shah.

Information Department,
Complete BBA Solution

Management Information System

Ch-8: Building Information System

Opening Case: CIMB Group Redesign for Account Opening Process

- Headquarter of **CIMB Group** is located in Kuala Lumpur, Malaysia and is second largest financial services provider and the third largest company on the Malaysian Stock Exchange.
- It provides services on full range of financial products and services along with consumer banking, corporate and investment banking, insurance and asset management.
- Its banking network is all over Southeast Asia with over 1100 branches.
- A Business Process Management System **ARIS** was introduced in 2008 to identify 25 different areas for improving technology, people and process and to overcome gaps and inefficiencies in existing process.
- New account opening process was introduced with the help of this technology.

Opening Case: CIMB Group Redesign for Account Opening Process

- The drawbacks like filling forms with all details of opening account with old process was recovered with the help of Government Multipurpose Card also known as **MyKad** which is provided to every Malaysian citizen which carry all the data that a bank needs to open an account.
- This is world first smart identity card, incorporating a microchip with different types of information like name, address, gender etc.
- It reduced the number of data entry screens and consumes less time which attracted customers.
- All the data are retrieved from MyKad card and data are entered using a single screen.
- It made the interaction between customers and bank more effective.

Opening Case: CIMB Group Redesign for Account Opening Process

- The company got benefitted mainly by increasing productivity and increased cost from 8 to 9 percent annually.
- This system also gave idea on organizing problems with existing information system, assessing people's information requirements, selecting appropriate technology and redesigning business processes and jobs.

System as Planned Organizational Change

There is change in organizational behavior regarding different aspects when there is an introduction of new Information System. These changes could be the change in hardware and software along with the working pattern in an organization.

System Development and Organizational Change

- When IT is involved in an organization, it makes changes in some aspects like **automation**, **rationalization**, **business process redesign** and **paradigm shifts**.
- When IT enables **automation** in change in organizational behavior, the employee perform their tasks more efficiently and effectively.
- **Rationalization** further support automation to overcome from the things it cannot explain.

System as Planned Organizational Change

- It is used for making a series of continuous quality improvements in products, services and operations such as ***Total Quality Management*** and ***Six Sigma***.
- **TQM** makes achieving quality and end in itself and the responsibility of all people and functions within an organization.
- **Six Sigma** is a specific measure of quality, representing 3.4 defects per million opportunities.
- In **Business Process Redesign**, business processes are analyzed, simplified and redesigned. It reorganizes workflows, combining steps to cut waste and eliminate repetitive, paper intensive tasks.
- It helps to reduce many complexities in an organization.

System as Planned Organizational Change

- **Paradigm Shift** involves rethinking the nature of the business and the nature of an organization.
- Though its success rate is very low due to hardly acceptance in extensive change, it is used because the rewards are very high as these strategies can lead to achieve results stunning & high order of magnitude in the return of investment

Business Process Redesign

- Many organization today are trying to improve their business processes by adopting Information Technology for incremental process changes.
- Business Process Management provides a variety of tools and methodologies to analyze existing process, design new process and optimize those processes.

System as Planned Organizational Change

- The requirement for continuous change in business process need have to go through following steps:
  1. **Identify process for change**: When systems are used to strengthen the wrong business model or business processes, the business can become more efficient at doing what should not have to be done. Managers need to determine what business processes are the most important and how improving these processes will help business performance.
  2. **Analyze existing processes**: Existing business processes should be modeled and documented, noting inputs, outputs, resources, and the sequence of activities.
  3. **Design the new Process:** Once the existing process is mapped and measured in terms of time and cost, the process is designed as a new one.

System as Planned Organizational Change

The new process design needs to be justified by showing how much it reduce time and cost or enhance customer service and value.

4. **Implement the new Process:** Once the new process has been thoroughly modeled and analyzed, it must be translated into a new set of procedure and work rules. The new process and supporting systems are rolled out into the business organization. Employees working with new process may recommended improvements.
5. **Continuous Measurement:** Once a process has been implemented and optimized, it needs to be continuously measured because processes may lead employee to fall back on old methods or a company may have to face unwanted changes.

System as Planned Organizational Change

- When properly implemented, business process redesign produces dramatic gains in productivity and efficiency and may even change the way the business is run.
- These kind of change is neither simple nor intuitive and companies committed to extensive process improvement need a good change management strategy.

Overview of System Development

- New Information Systems are an outgrowth of a process of organizational problem solving.
- The problem may be one in which managers and employees realize that the organization is not performing as well as expected or that the organization should take advantage of new opportunities to perform more successfully
- The activities that go into producing an information system solution to an organizational problem or opportunity are called System Development. These activities consist of system analysis, system design, programming & testing, conversion and production an maintenance.
- It is done in sequential order but sometime processes need to be performed simultaneously.

Interactive Session: Can Business Process Management make a Difference

- AmerisourceBergen is one of the largest pharmaceutical service company and a member of the Fortune 25.
- It has a large business which has complicated relationship with manufacturers, pharmacies and hospitals.
- Frequently changing business conditions cause contract prices to fluctuate which made trouble to analyze data of contract and price detail associated with each of these relationships.
- To reduce the complexity, it chose Metastorm BPM software in which there were presence of tools for analyzing, managing and redesigning business processes.
- Metastorm has an engine for deploying redesigned processes along with capabilities for integrating the processes it manages with external system.

Interactive Session: Can Business Process Management make a Difference

- With the help of this system creation of rich graphical models of business processes as well as new user interface and business was possible.
- It used the application for the first time on online collaborative contract and chargeback process which was responsible for $10 billion.
- Metasource BPM makes it possible for all contract changes to be recorded into the system and validate against internal business rules and also enables AmerisourceBergen to link with its trading partners for collaborative BPM.
- The BPM project was successful and resulted in lower headcounts, fewer disputes, more accurate pricing information and a high return on investment.

Interactive Session: Can Business Process Management make a Difference

- AmerisourceBergen use Metastorm BPM to create six new specialized process for managing and automating high volume, highly specialized supplier credits which interface with its SAP enterprise system.
- It was adopted by the company as it has ability to receive, track, reconcile and expedite all credit variances.
- AmerisourceBergen has automated nearly 300 processes benefiting from more efficient and accurate record tracking, faster turnaround time, greater management into key performance indicators and an online audit trail of all activities
- The company also won a Global Excellence in BPM and Workflow award in 2009.

Interactive Session: Can Business Process Management make a Difference

- Diebold. Inc. is another company in integrated self service delivery and security system and services with 17,000 associates across 90 countries.
- This company makes, installs and services ATMs, vaults, currency-processing systems and other security systems used in financial, retail and Government market.
- This company selected Progress Savvion's BusinessManager BPM for using business process management to understand and improve its order fulfillment process.
- It was provided a web based application for the purpose which gives managers real time visibility to monitor, analyze, control and improve the execution of those processes and can integrate these processes with existing operational systems.

Interactive Session: Can Business Process Management make a Difference

- Diehold managers are able to track orders in real time at any step in the process and also predict future performance based on past data which helped them to forecast where orders ought to be and compare that with where the system says the orders actually are.
- Also the detection of production of item can be done and where specific item are located can be found out.
- The System was also used for issue resolution which aggregates input from various sources such as worker in field and in factories

Interactive Session: Can Business Process Management make a Difference

- Answer the Case Study Question
- Refer page no. 504
- Be precise with your answers.
- Also look at MIS in Action to be familiar with Real Time Questionnaire.

System Analysis

- System analysis is the analysis of a problem that a firm tries to solve with an information system which consist of defining the problem, identifies the causes, specifying the solution and identifying the information requirements that must be met by a system solution.
- System analysis is done by System Analyst who examines documents, work papers and procedures, observing system operations and interviewing key users of the system
- It consist of feasibility study to determine whether that solution is feasible or achievable from a financial, technical and organizational standpoint.
- The system analysis process identifies several alternative solutions that the organization can pursue and assess the feasibility of each.

System Design

- When the analysis part is over, we move to the design part which shows how the system will fulfill this objective. It is the overall plan or model for that system.
- It consist or system specifications that will deliver that functions identified during system analysis which consist of all of the managerial, organizational and technological components of the system solution.
- Working on design increases users' understanding and acceptance of the system so that they have their sufficient control over the design process to ensure that the system reflects their business priorities and information need not the biases of the technical staff.

Completing the SDP

- After analysis and design, all the components picked up are translated into fully operational information system which includes following steps:
  - **Programming**: it is a process where system specifications that were prepared during the design stage are translated into software program code. In an organization, software are generally purchased from vendor or they outsource.
  - **Testing:** After the completion of the application, it must be tested to check its functionality. During test data must be carefully prepared, result are reviewed, and correction are made in a system. For the preciseness, testing is also done in three parts viz. ***unit testing, system testing*** and ***acceptance testing.***

Completing the SDP

Sometimes conversion is needed to change the old process into new one for which different strategies are used viz. ***parallel strategy, direct cutover strategy, pilot study strategy*** and the ***phased approach strategy***.

- **Production and Maintenance:** After the new system is installed and conversion is completed, the system is said to be in production. During the stage, the system will be reviewed by both users and technical specialists to determine how well it has met its original objectives and to decide whether any revisions or modifications are in order

  After the system has been fine tuned, it must be maintained while it is in production to correct errors, meet requirement or improve processing efficiency.

Completing the SDP

Changes in hardware, software, documentation or procedures to a production system to correct errors, meet new requirements or improve processing efficiency are termed as maintenance.

Modeling & Designing Systems

When we need to design or develop a system we follow different approaches and methodologies. Those approaches are generally picked up as either structured or object oriented programming language.

Structured Approach:

- Structured refers to the technique that it works step by step, with each step building on the previous one.
- Structured methodologies are top-down, programming from the highest, most abstract level to the lowest level of detail.
- These are process oriented, focusing primarily on modeling the processes or action that capture, store, manipulate and distribute data as the data flow through a system

Modeling & Designing Systems

- A separate programming procedure must be written every time if someone wants to take an action on a particular piece of data
- To represent a system's component processes an the flow of data between them is done by using a tool called **Data Flow Diagram**
- The data flow diagram offers a logical graphic model of information flow, partitioning a system into modules that show manageable levels of details specifying processes and transformation that occur within each module and the interface that exist between them.
- Another tool for structured analysis is a **Data Dictionary** which contains information about individual piece of data and data grouping within a system.

Modeling & Designing Systems

- Process Specifications describe the transformation occurring within the lowest level of the data flow diagram.
- Another tool used is Structure Chart which is a top down chart showing each level of design, its relationship to other levels and its place in the overall design structure.

Object Oriented Development:

- To overcome the separation of data and processes, object oriented approach is considered.
- Object oriented development uses the object as a basic unit of systems analysis and design which combines data and the specific process that operate on those data.
- Instead of passing data to a procedure, programs send a message for an object to perform an operation.

Modeling & Designing Systems

- Because processing logic resides within objects rather that in separate software program, objects must collaborate with each other to make the system work.
- Object oriented modeling is based on the concepts of class and inheritance.
- Objects belonging to a certain class or general categories of similar objects have the features of that class.
- The information system is implemented by translating the design into program code, reusing classes that are already available in a library of reusable software objects and adding new ones.
- Since objects are reusable, it could potentially reduce the time and cost of writing software .

Alternative System Building Approaches

System differ in terms of their size and technological complexity and in term of the organization it is meant to be solved using different approaches.

Traditional System Life Cycle

- The one of the oldest method of building a system is a phased approach. In this process, System Development Specialists divide the system building stages.
- Technical Specialists are responsible for much of the system analysis, design and implementation work where end users are limited to providing information, requirements and reviewing the technical staff's work.
- This approach works on requirement analysis, predefined specifications and tight control over system building approach.

Alternative System Building Approaches

- It follow waterfall approach in which next stage can't be touched before completing the existing one.
- In this approach steps can be retraced and specifications can be revised.

Prototyping

- Prototyping consists of building an experimental system rapidly and inexpensively for end users to evaluate.
- Once this model is operational, it will further refined until it conforms precisely to users' requirements. Once the design is finalized, the prototype can be converted into final system.
- It can also be called iterative process because the steps required to build a system can be repeated over an over again.

Alternative System Building Approaches

Steps in Prototyping:

- Step1: identify the users' basic requirements
- Step2: develop an initial prototype
- Step3: use the prototype
- Step4: revise and enhance the prototype

End-User Development:

- Some types of information system can be developed by end users with little or no formal assistance from technical specialists and this phenomenon is called end-user development.
- Fourth generation programming languages enables end users to create reports or develop software application.

Alternative System Building Approaches

- The fourth generation software can be procedural or non procedural programming languages.
- Fourth generation software contain seven categories: PC Software tools, Query Languages, report generations, graphics languages, application generations, application software packages and very high level programming languages.
- End users are most likely to work with PC software tools and query languages.
- End users develop systems can be completed more rapidly.
- The tools developed by end-users are not conventional as it cannot easily handle the processing of large number of transactions or application with extensive logic and updating requirements.

Alternative System Building Approaches

Application Software Packages:

- Most of the applications are build on the basis of package system which includes common applications for many organizations such as payroll, accounts receivable, general ledger or inventory control which are used for long period of time and fulfill the requirements.
- In such cases, a company purchase prewritten, predesigned, pretested software programs from the package to minimize time
- In case of unique requirements that the package cannot fulfill they have the capability of customization which allows a software package to be modified to meet an organization's requirement without destroying the integrity.

Alternative System Building Approaches

- Such packages are evaluated on the basis of package, flexibility, user friendliness, software and hardware resources, database requirements, installation and maintenance efforts, vendor quality, documentation and cost which is asked as *Request for Proposal* submitted to software vendors.
- In the case when customization could not be taken place, the organization have to adopt the package system and change the working procedures.

Outsourcing:

- In case, if a firm does not want to use its internal resources to build or operate information systems, it can outsource the work to an external organization that specializes in providing these kind of services.

Alternative System Building Approaches

- In another case of outsourcing, a company could hire another company, either domestic or of another company, to design and create the software for its system.
- In case of domestic outsourcing for supply chain management, a company require around 50 number of employees with specific expertise and who might need extensive training which is considered as expensive decision rather it outsource a company who can fulfill all the requirement in low cost with better efficiency.
- In contrary, the Internet and low cost communication technology have drastically reduced the expense and difficulty of coordinating the work of global teams in faraway locations & get chance of utilizing global expertise.

Alternative System Building Approaches

- Any company that outsources its applications must thoroughly understand the project, including its requirements, methods of implementation, anticipated benefits, cost components and metrics of measuring performance.
- The vendors should fulfill the contractual obligations & thoroughly understands the business along with the company should need to allocate resources for documenting requirements, sending out RFPs, travel expenses, negotiating contracts and travel expenses so that the project should be delivered in certain time period.
- Outsourcing enables a company to reduce its hidden cost along with the complexity of dealing with Human Resources issues of hiring and firing employees.

Alternative System Building Approaches

- This is also useful in analyzing best case and worst case scenario for the total cost of an offshore outsourcing project.
- Best cases can be picked up for the estimation of total cost in low level and the worst cases can be picked up to eliminate the highest estimation of these cost.

Interactive Session: Zimbra Zooms ahead with OneView

- Zimbra is a software company whose flagship product is Zimbra Collaboration Suite (ZCS) which is an open source messaging and communication software package that relies heavily on Ajax to provide a variety of business functions.
- It was purchased by Yahoo in 2007 but now have its own 50 million users to it provide services like mailbox, contact lists, shared calendar, instant messaging, hosted documents, search and VoIP which can be accessed by any supportive mobile.
- Negative feedback were taken by the company which lead the company and the package to be very successful.
- It offers two type of packages which includes free (as trial) and paid versions which can be downloaded from its web site which visiting rate is 200000 visitors per week.

Interactive Session: Zimbra Zooms ahead with OneView

- The free version has some basic features being used by users who are persuaded to switch to the paid version.
- Salespersons identify the users who use the application most likely to upgrade to the commercial version.
- Those users are identified and contacted by email address and telephone numbers.
- Zimbra uses its website to track its visitors ‘ activity and tie it to sales lead information in its Customer Relationship Management System (salesforce.com).
- At initial phase, Zimbra used marketing automation software from Eloqua which had a large number of unfavorable features but was too complicated for both marketing and sales staff to use.

Interactive Session: Zimbra Zooms ahead with OneView

- Its was unsuccessful because of various reasons such as salespersons need had to code conditional logic for any data field containing data they wanted to collect which consumes lots of time. Also it only worked with IE while 2/3rd of the Zimbra's Staffs used Mozilla firefox. The application was expensive as well
- Since Zimbra could not afford any of its employee to be administrated use Eloqua's features, it planned to switch the system.
- For this it examined many software products from which it choose OneView from LoopFuse which specialize in sales and marketing automation.
- It was found less time consuming in every aspect.

Interactive Session: Zimbra Zooms ahead with OneView

- The core functions of OneView include Web Site visitor tracking, automated marketing program communication, customer activity alerts and CRM integration.
- It was also convenient pricing options included unlimited seating and pay per use options.
- Other benefits of OneView include easy integration with salesforce..com. Zimbra's preferred CRM solution, simplified reporting processes and the ability to manage large number of leads was solved along with browser compatibility.
- OneView reduced the amount of time Zimbra spent using and maintaining its marketing system by 50 percent and jump in its close rate on qualified sales leads from 10 to 15 percent.

Interactive Session: Zimbra Zooms ahead with OneView

- Answer the Case Study Question
- Refer page no. 521
- Be precise with your answers.
- Also look at MIS in Action to be familiar with Real Time Questionnaire.

Application Development for Digital Firm

- In digital environment, organizations are able to add, change and retire their technology capabilities very rapidly to respond to new opportunities that provide very fast solution.
- With the help of software packages and external service providers, business are relying more heavily on fast cycle techniques.
- These techniques could be considered as rapid application development, joint application design, agile development and reusable standardized software components.
- These features can be assembled together to make a complete set of services as required.

Rapid Application Development

- The term **Rapid Application Development (RAD)** is used to describe the process of creating workable systems in a very short period of time.
- These application are generally developed with the help of object oriented software tools, reusable software, prototyping and fourth generation software.
- Using any method along with the visual programming, it can be performed by close teamwork among the end users and the technical specialists where process does not have to be sequential and key part of the development can occur simultaneously.
- An application which comes from an interactive session among end users and the Information System specialists for system development is termed as **Joint Application Design (JAD)**.

Rapid Application Development

- Likewise, **Agile Developme**nt focuses on rapid delivery of the working software by breaking a large project into a series of small subprojects that are completed in short period of time using iteration and continuous feedback.
- Improvement or addition of new functionality takes place within the next iteration as developers clarify requirements.
- Agile methods emphasize face to face communication over written documents, encouraging people to collaborate and make decisions quickly and effectively.

Component Based Development & Web Services

- This type of development is based on the concept of object oriented programming where object are used.
- The components are said to be the group of objects assembled together to perform some kind of task such as a graphical user interface or online ordering system.
- The approach used in software development is known as component based development and it enables a system to be build by assembling and integrating existing software components.
- This technology is generally used for e-commerce.
- In web services, the combination of markup language and other open protocols and standards enable one application to communicate with other without customization.

Component Based Development & Web Services

- As web services follow universal set of standards being less expensive and less difficult to weave together, it is generally preferred.
- It can complete some complex transactions such as checking credit, procurement or ordering products being independent from operating system, programming language or client device.

Hands on MIS

Improving Decision Making: Using Database Software to design a customer system for auto sales

- *Refer to book, Page no. 525*

Achieving Operational Excellence: Redesigning Business Processes for Web Procurement

- *Refer to book, Page no. 526*